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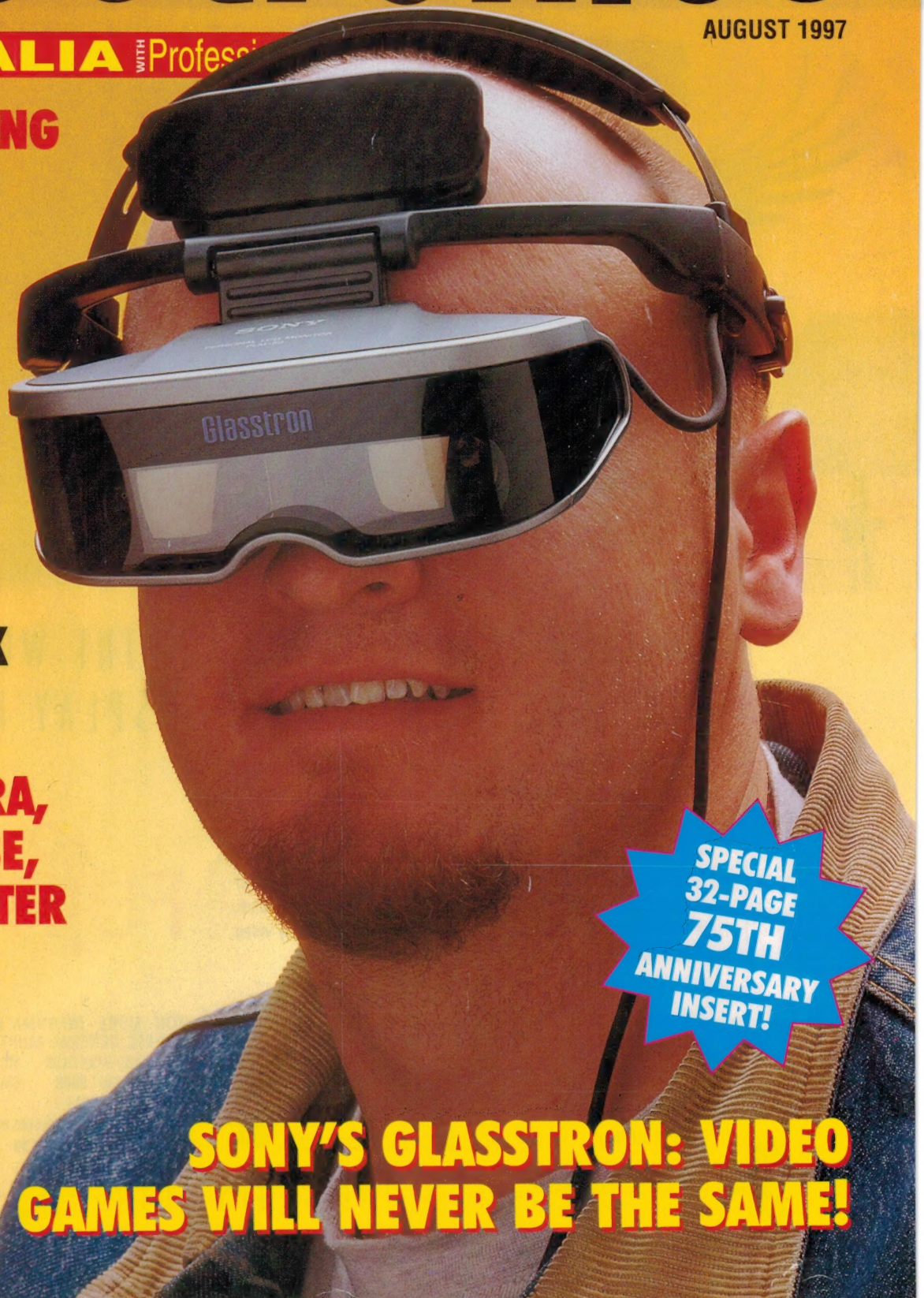

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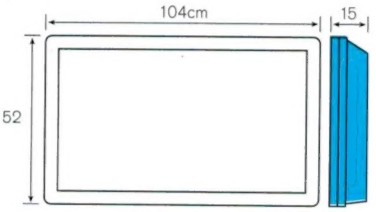

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AUSTRALIA with Professional Electronics & ETI

Volume 59, No.8
August 1997

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Win a Baygen Freeplay!

The Baygen 'Freeplay' wind-up clockwork radio has created a lot of interest around the world, especially among people in developing countries. Now it's available in Australia, as we explain on page 18.
Dick Smith Electronics has kindly donated one of these novel (and practical) radios to us, to offer to our readers as a prize. We've decided to offer it to the reader who comes up with the most imaginative and/or interesting use for a wind-up radio. So if you'd like to be in the running to win it, fire up your imagination and see what you can dream up...
Send your entry to 'EA Win A Baygen Freeplay Competition', PO Box 199, Alexandria 2015. It should be posted no later than August 29, 1997.

This competition is open to Australian residents only. Entries received after the closing date will not be included. Employees of the Hannan Group or Dick Smith Electronics, their subsidiaries and families are not eligible to enter. The prize is not transferable and may not be converted into cash. The judges' decision is final and no correspondence will be entered into. Description of the competition forms a part of the competition. The competition commences 23.7.97 and closes last mail 29.8.97. The judging will take place in Sydney on 3.9.97 at 11am and the winner will be notified by mail and announced in a later issue of Electronics Australia. The prize is one Baygen Freeplay radio valued at $149. Total prize value $149.

On the cover

Sony's new Glasstron head-mounted video monitor hasn't reached the Australian market as yet, but our reviewer Louis Challis has been able to try out this advance sample. His reaction? Computer and video games will never be the same again. See his review starting on page 10. (Photo by Phil Aynsley).

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MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
TECHNICAL EDITOR
Rob Evans, CET (RMIT)
PROJECT DESIGNER/WRITER
Graham Cattley
PRODUCTION EDITOR
Witold Budzynski, B.Sc.
CONTRIBUTORS
Louis Challis
Arthur Cushen, MBE
Roger Johnson, VK5ZKP
Jim Lawler, MTETIA
Jon Loughron, Assoc. Dip. Elect.
Tom Moffat, VK7TM
Peter Phillips, B.Ed., Dip Ed., ECC
Nick de Vries, MIAME, AMSAE
READER SERVICES CO-ORDINATOR
Ana Marie Zamora; phone (02) 9353 0620
DRAFTING
Drawquick Computer Graphics
COVER DESIGNER
Clive Davis
ADVERTISING MANAGER
Selwyn Sayers
Phone (02) 9353 0734; fax (02) 9353 0613
ADVERTISING PRODUCTION
Kevin Miller; phone (02) 9353 0601
PRODUCTION
Ray Eirth
CIRCULATION MANAGER
Michael Prior
HEAD OFFICE - EDITORIAL
PO Box 199, Alexandria 2015.
180 Bourke Road, Alexandria 2015.
Phone (02) 9353 0620; fax (02) 9353 0613
E-mail: electaus@magna.com.au

Subscriptions Enquiries:
phone (02) 9353 9992; fax (02) 9353 0967.
Computer Bulletin Board: (02) 9353 0627

INTERSTATE ADVERTISING SALES
MELBOURNE: Kayren Browne
504 Princes Highway, Noble Park, 3174.
Phone (03) 9213 3222; fax (03) 9701 1534.
BRISBANE: Graham Smith
26 Chermside Street, Newstead 4006.
Phone (07) 3854 1119; fax (07) 3252 3692.
ADELAIDE: Sue Bowshall
98 Jervois Street, Torrensville, 5031.
Phone (08) 8352 7937; fax (08) 8352 6033.

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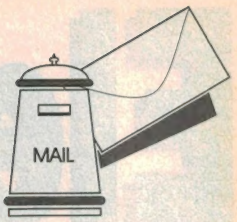
LETTERS TO THE EDITOR



RMS current monitor

Thank you for the excellent job your magazine did with the High Isolation Current Adaptor (Nov 96 issue). It is these articles that help small electronics companies like Fastron Technologies to educate and promote new technologies within Australia.

Because of the cost in promotion of new products most companies like ourselves will only promote when they hold the exclusive Australian agency for that product. Even when this is the case we still miss out on sales. One kit distributor for the high isolation current adaptor, knowing we were the distributor for the LEM HY10-P transducers, bypassed us and bought their stock on the international black market.

Now I see in the May 1997 issue another construction project using a LEM product, the RMS Current Monitor on page 57. The article refers to the first construction project, but when we get to the parts list on page 61 it tells people to buy the LEM LTA50P/SP1 from Farnell. This item is a standard product we carry in stock and hold the exclusive Australian agency for.

I have gone back through the last 12 issues of *Electronics Australia* and cannot find one advertisement from Farnell; but every second month there was one for Fastron Technologies. Yet you assist other companies from making profits from our endeavours.

I hope you can do something to stop this unfair situation from arising again.

Andrew Shaw
Sales & Marketing Manager,
Fastron Technologies
Dandenong, Victoria.

Our apologies, Andrew, and we appreciate your position. Hopefully publishing your letter will make some amends.

Mortified by fusing

I have just received the May issue of your excellent magazine and was mortified by the circuit of the RMS Current Monitor. I would have thought that after all the correspondence over the years in Forum re fuses/switches in neutrals of 240V mains connected circuits, that someone at EA would cast a cursory glance at circuits involving mains voltage.

In this circuit when in the 2amp range we have a fuse in the neutral which is extremely dangerous and highly illegal under any circumstance and a switch whose legality is questionable if it does not have a pole in the corresponding active conductor.

To make the situation safer and legal the circuit should be republished with the neutral connected straight from the input to the output and the active going through the fuse/relay contacts etc.

F.J. Thorpe
Narrabeen, NSW.

Similar criticism

I can hardly believe what I just noticed in the circuit diagram of Phil Allison's RMS Current Monitor in your May 1997 issue: the device provides a 240V outlet, switched by a relay in the *neutral* line.

I admit I haven't yet tried to follow through the PCB and overlay diagrams to check that they actually implement this insanity; but I suggest an urgent erratum either way.

David Brownridge
(via the BBS).

The designer replies:

I would like to respond to the intemperate complaints made by Mr F.J. Thorpe and others about my RMS Current Monitor, and allay any unnecessary fears about its safety. Firstly, the unit is not legally required to comply with the rules for domestic appliances as it is clearly a test instrument. Electrical authorities require no type approval for test equipment and expect that only the technically competent would own or use such items.

Secondly, the 'extremely dangerous' tag cannot be justified. When the 6.3A fuse protecting the 2A range fails, there is no reading on the display and until the fuse is replaced the neutral return path will be open at the GPO socket. There is no particular danger created by this, while any appliance plugged into the GPO will temporarily not work.

Thirdly, having the range switching circuit in the neutral line is not equivalent to placing a power switch in the neutral. As fully explained in my article,

the relay contacts assisted by triac arc suppression simply change ranges without interrupting the load.

I agree that an appliance should have its power switch and any supply fuse in the active line to protect against large fault currents to earth. Using my RMS Current Monitor in no way interferes with this desirable arrangement.

Phil Allison
Summer Hill, NSW.

Birthday message

So — this hoary old magazine has lasted 75 years, and shows no sign of going belly-up yet. This is good for a freelance writer like me. Although I've been 'working' for Electronics Australia for something like 18 years now, I've never been employed by them. Yet life goes on in the Madhouse.

My files are littered with letters from defunct magazines — or worse, receiver-managers. 'Anyone having a claim against this company...' or sometimes, 'where can we send the photographs that were never used'. But dear old Granny EA kicks on.

You should see some of the twaddle that passes for electronics magazines over here in the USA. Who thinks it's time we talk Jim Rowe into a US edition? We'd MURDER 'em — how about it, Jim? Yaaayyyy!

Tom Moffat
Port Townsend, Washington.

And another...

Congratulations, on 75 years of continuous publication, from *Wireless Weekly* to today's *Electronics Australia*.

Please find enclosed an old copy of *Radio and Hobbies*, dated August 1947, which was your 25th Anniversary copy. Now with this copy you're celebrating the 50th year since *it* was published. Please keep this edition for the magazine's historical collection.

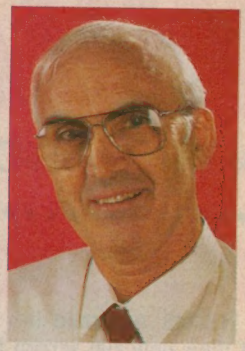
Keep up the good work for another 75 years. Unfortunately I don't think that I will be around to renew my subscription by then.

Reg Leahy
Shepparton, Victoria.

Thanks very much for the kind words, Reg, and also for the copy of the August 1947 issue. We'll certainly keep it in our collection, as you ask. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Welcome to our 75th Anniversary issue — and thanks!

This issue is a rather special one for us, as you might imagine, because it marks the magazine's 75th Anniversary. We can trace its origin all the way back to August 4, 1922, when the first issue of a little radio magazine called *Wireless Weekly* went on sale in Sydney. It was from that modest beginning that today's *Electronics Australia* grew, changing along the way from a weekly into a monthly and through a number of changes of name: to *Radio and Hobbies* in 1939, to the rather cumbersome *Radio, Television & Hobbies* in 1955, and finally to the present name in April 1965. The content material also changed, gradually becoming more and more focussed on the technical side of electronics as the technology itself developed and expanded.

Not many electronics magazines in the world can claim this kind of longevity, and we're somewhat proud of the achievement. In those 75 years quite a few radio, television, electronics, communications and computing magazines have come and gone, both in Australia and in the wider world. To have survived this long, in a relatively small local market, seems in itself something of an achievement.

Hopefully at least one of the factors behind this survival has been the continuing efforts by the magazine's editors and writers, over the years, to ensure that it evolved and adapted to suit the developing technologies and changing needs of its readers. I know that was one of the goals of my predecessor and mentor Neville Williams, and I've tried to follow it as well.

At the same time, all of us currently working on *EA* are also well aware that this kind of survival depends upon many other factors as well. Including, of course, the ongoing and practical support of our many readers and advertisers. Without these crucial groups of supporters, no magazine can survive for long at all, let alone for 75 years...

So along with a little pride, we're also feeling a great deal of gratitude to you, our loyal readers, and also to the advertisers you attract. Please accept our sincere thanks, for your equally important role in this achievement — and please *keep* playing your role in the magazine's survival!

In the meantime, settle back and enjoy what we've prepared for you inside, to celebrate this milestone. Along with all of the usual features, columns and departments you'll find a special 32-page supplement in the centre, with articles looking back over the last 75 years and what has happened to both electronics and the magazine itself. I hope you'll find them all both interesting and enjoyable.

Jim Rowe

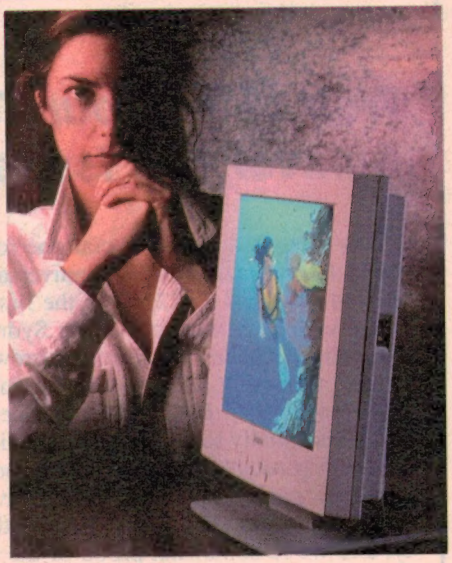
PS: By the way, try not to miss *next* month's issue either, because it will come with a special free copy of the 100-page catalog and reference book: *Computers, Music and MIDI: The Bible*, normally $3 from Moore Music.

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS

Hitachi's Super TFT flat-screen monitor

Hitachi Australia has released details of their new flat screen LCD data monitor, now available in Australia. The monitor uses a new Hitachi patented technology known as In-Plane Switching (IPS) TFT, and is claimed to offer users for the first time the benefits of the wide viewing angle traditionally found on CRT monitors (with no colour shift) and extended resolution, plus over 16 million colours.



The new monitor features a display size of 13.3", equivalent to a screen area of a 15" CRT style monitor. Maximum resolution is 1024 x 768, with standard CRT multi-scan operation allowing 'on-the-fly' changes to other resolution modes such as 640 x 480 and 800 x 600 with accurate pixel reproduction. Microsoft 'Plug and Play' under Windows 95 is also supported, ensuring that the panel can easily replace an existing CRT monitor simply by changing the plug.

What also separates this new Hitachi monitor from older style TFT panels is its ability to display over 16 million colours using Hitachi's Frame Rate Control System (FRC). This system electronically creates colours that cannot be reproduced on other manufacturers' panels.

Measuring (with stand) a mere 365 x 315 x 199mm (depth of display is only 85mm) and weighing only 6kg the Super TFT monitor takes up only a fraction of the desk space of a traditional CRT monitor, important in today's shrinking office space era. Power consumption at only 45W is less than half that of a CRT monitor and DPMS power management further lessens power use in non-active times.

Active Subwoofer from VAF Research

South Australian hifi speaker manufacturer VAF Research has released its new DC-S active subwoofer for use in both home theatre and audiophile systems. The newest addition to its critically acclaimed DC-Series, the DC-S has been designed to provide true audiophile bass performance in a compact unit.

Pitch definition, texture and transient response are claimed to be superior to other products in its class. Low distortion and clear, detailed sound have been achieved, even at levels in excess of those required for domestic listening. This makes the new subwoofer suitable for extending the frequency response of existing speaker systems, and well as providing the important 'low end' components as part of a premium quality home theatre system.

Available only fully assembled, the DC-S measures 430 x 430 x 430mm and features a fully mitred cabinet made from high density MDF with all visible surfaces lacquered with two-part acid catalysed black lacquer. The enclosure is a bandpass type fitted with Hypersoft foam internal damping material. The drivers are two of VAF's 210mm fibreglass cone woofers, featuring a powerful magnet and motor assembly, multi-layer voice coil and large excursion capability.

The internal power amplifier is an advanced Class AB design delivering 180W RMS, and featuring a sophisticated control circuit with auto on/off. The design includes a second order low-pass filter with acoustic crossover frequency continuously adjustable between 40Hz and 125Hz, an additional fixed pole at 250Hz and a third order high-pass filter to limit cone excursion at subsonic frequencies.

The DC-S is fitted with left and right line level RCA inputs, and also stereo speaker-level binding post inputs. The sensitivity for maximum output at 30Hz is 100mV RMS (line inputs) and 1V RMS (speaker inputs) respectively. A level control is provided to match speakers with sensitivity up to 100dB/watt. The rated maximum SPL is 110dBA at 1m, at 35Hz.

The DC-S is priced at $1000, plus $23 for fully insured freight.

For more information circle 143 on the reader service card or contact VAF Research at 291 Churchill Road, Prospect 5082; FREECALL 1800 818 882 or (08) 8269 4446 (Web site at **http://www.vaf.com.au**).

HP launches its PhotoSmart photo system

Hewlett-Packard has officially introduced to Australia the HP PhotoSmart PC photography system, claimed as the first PC photography system designed for home users.

The new PhotoSmart system includes a photo printer, photo scanner, digital camera and photographic papers, all designed to allow home consumers to take original digital photos or scan in existing photos, slides or negatives and then edit or reproduce those photos at home. HP says the system offers a new level of flexibility and creativity, enabling users to make professional-looking prints, reprints and enlargements of photos that can be incorporated into personalised greeting cards, calendars and postcards.

All three HP PhotoSmart PC photography products come with Picture It!, Microsoft Corp.'s new image manipulation software. Picture It! enables home users to edit and enhance photos easily in a variety of creative ways, including cropping out unwanted elements, removing 'red eye', adding borders and clip art or merging several photos together for a collage or other project.

The first product to be available is the HP PhotoSmart digital camera. The HP PhotoSmart photo printer and photo scanner are expected to be available later this year. Each component in the system may be purchased separately. The components support multimedia PCs running Windows 95.

As noted in this column a couple of months ago, the HP PhotoSmart digital camera allows users to download their pictures to a PC instantly. Using removable HP Photo Memory Cards, which are available in 2MB or 4MB configurations, it allows users to take an unlimited number of photos. Built around an all-glass, seven-element lens, it is designed to capture images in any of three resolutions — normal, fine or superfine. The camera is equipped with an integrated flash and features automatic focus and exposure control and an automatic date and time stamp.

The HP PhotoSmart photo printer is designed to provide users with professional-quality prints that look and feel as if they came from a professional photo-finishing lab. The printer features a straight-through paper path designed for thick photo papers. The printer uses six ink colours (in two tri-chamber cartridges) to deliver richer, smoother colours and the subtle tones associated with photos. The printer prints a 20.32 x 25.40cm photo in five minutes and a 10.16 x 15.21cm photo in 2.5 minutes.

The HP PhotoSmart photo scanner scans existing photographic prints, or 35mm negatives and slides. The scanner comes with software that allows the user to preview a scanned photo in order to balance colours, correct exposures and flip or rotate images before completing the final scan. The scanner will allow a user to preview the image on-screen in about 10 seconds. It completes a typical scan in less than a minute.

HP's PhotoSmart photographic papers are available in matte and glossy finishes. Photos printed on these papers are virtually indistinguishable from traditional photos. In addition to the photographic papers, HP also offers PhotoSmart Greeting Cards and Note Cards (with coordinating envelopes), which can be printed on both sides, and HP PhotoSmart Post Cards.

For further information on HP products and services is available toll-free, Australia-wide, by calling 131347 (no STD area-code required).

12-channel GPS receiver is sensitive

GME Electrophone has announced the release of the Garmin GPS 12XL, a 12-parallel channel GPS receiver designed especially for fishermen, hunters and hikers who navigate with GPS in the most challenging environments.

The GPS 12XL has all the advanced features that have made Garmin the best selling name in handheld GPS. Coupled with a high performance 12-channel receiver, this is claimed to result in a GPS receiver that allows people to explore places they never thought possible.

The GPS 12XL uses the powerful PhaseTrac12 engine to gather data from the GPS satellites, for quick and reliable first-time initialisation. Its increased sensitivity to weak satellite signals and over-sampling of stronger, existing signals is also claimed to give consumers more precise position information, faster than ever. The GPS 12XL will also maintain satellite lock under the most difficult conditions, including dense tree canopy and urban obstructions.

Unlike other 12-channel handhelds, the GPS 12XL allows for simple one-hand operation and can be complemented with an external antenna. Additionally, an internal lithium battery back-up keeps your data safe when the unit is turned off for long periods.

Other significant GPS 12XL features include a backlit LCD display for clear visibility day or night, and up to 12 hours of operation from four AA batteries.

The sensitive receiver at the heart of the GPS 12XL is protected by a rugged, compact case that features the same tough construction as Garmin's military models, which are required to meet stringent government specifications.

For more information circle 142 on the reader service card, contact your local GME Dealer, or GME on Sydney (02) 9844 6666.

Mini systems include SRS '3-D'

Kenwood's new XD-750 and XD-700 mini sound systems feature an extra large, informative fluorescent display panel that is designed to be both attractive and functional, and also a range of technological innovations including Sound Retrieval System (SRS) 3-D sound system technology. SRS 'brings out' the ambience found in most stereo program sources, and processes the signals so that the listener's ears and brain believe the sound is not just coming from two speakers, but a multitude of sound sources. (SRS is a patented system of SRS Laboratory in the USA.)

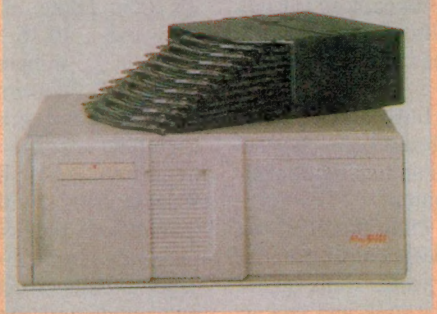
In addition to SRS the new Kenwood XD-700 and XD-750 offer a colour choice of either silver (XD-750) or black (XD700) and both provide an output of 100 watts RMS per channel. They also incorporate a three-disc carousel CD player with play exchange feature, a full logic control twin auto reverse cassette deck with Dolby B noise reduction, an electronic tuner with 40 memory presets, and three-way speakers.

For lovers of karaoke both the XD-750 and XD-700 mini systems also incorporate two mic inputs. A full function remote control addresses all functions of the systems.

The XD-750 and XD-700 both carry an RRP of $899, are covered by a two-year warranty and are available at selected dealers. For further information circle 144 on the reader service card or contact Kenwood Electronics on (02) 9746 1888.

10-disc CD changer for cars

Kenwood's latest release 10-disc CD changers, the KDC-C810 and the KDC-C710, are designed to accompany any CD player-receiver or cassette-receiver with CD changer control. Ultra-compact and silver in colour, the new models can be mounted in your vehicle horizontally, vertically, or even at an angle of 45° — allowing you the choice of an accessible or remote position for the changer.



Both the KDC-C810 and KDC-C710 have been designed to withstand the rigours of the road. The 'Balanced Floating Mechanism' is claimed to cushion crucial areas so that they withstand the disruptive forces associated with modern car travel, resulting in smooth, uninterrupted operation.

The KDC-C810's new DRIVE (Dynamic Resolution Intensive Vector Enhancement) circuit is claimed to improve fidelity, by removing quantisation noise from small signals. Using an array of special low-pass filters, DRIVE is said to achieve 20-bit equivalent resolution. In the DAC section, the digital/analog converter raises the oversampling rate — resulting in lower high-region distortion and smoother sound reproduction.

The KDC-C710 features Digital Pulse Control (DPAC II), combined with a balanced floating mechanism, eight-times oversampling and Digital Servo System.

Both changers are covered by a 12-month warranty and are available at selected Kenwood car audio dealers. For further information circle 141 on the reader service card or contact Kenwood on (02) 9746 1888.

Improved SuperPhone

Panasonic has upgraded its very successful faxtam dubbed the 'SuperPhone' and called it the 'SuperPhone 2' (UF-S2AL). The upgraded unit features a hands-free speakerphone which allows users to speak on the phone while using both hands to continue with other tasks. Panasonic claims it's compact size (266 x 231 x 95mm) makes it ideal for replacing a conventional phone handset in the home.

The function buttons of the SuperPhone 2 have been rearranged to make specific functions easier to access, and there have been some cosmetic changes made. The unit now also has 20 pages of out-of-paper memory for faxes.

Other convenient fax features include automatic fax/phone switching, 64-level halftone capability and remote reception. The SuperPhone 2 automatically detects if a call is a fax or phone call and switches to the appropriate mode.

The digital telephone answering machine has no tape so message access is fast. As well as taking messages from callers, messages can be left as memo items for other members of a household. The SuperPhone 2 can also be used for call screening but has the ability to recognise specific callers and allow the phone to override the answering machine.

The Panasonic UF-S2AL SuperPhone 2 is available from leading electrical and communications retailers for an RRP of $599. For further information contact Panasonic's Customer Care Centre on 132 600.

Cellphone has big LCD display

According to Nokia things always look better on a big screen, and with this in mind its new Nokia 3810 cellphone is designed to combine very small overall size with a generous display for improved visibility.

The large four-line by 13 character display also incorporates a 'dynamic font size' which adjusts automatically for the best viewing. This is said to allow you to read messages on the screen from just about any convenient distance, and make reception of short messages a pleasure.

Managing Director for Nokia Mobile Phones Australia, Martti Malka said "The special large screen of the Nokia 3810 will accommodate an increase in the use of short message services (SMS). As value added services increase, large screens will become even more important. For example, short grabs of information from the Internet including flight details and restaurant recommendations can be easily read on a large screen."

The Nokia 3810 provides impressive standby and talk time capabilities. The standard 550mAh NiMH battery weighs only 187g and has a talk time of 1.5 - 2.75 hours and a standby time of 40 - 95 hours. The optional extended 1500mAh Li-Ion battery takes this performance to 4 - 7 hours talk time and 120 - 250 hours standby.

The Nokia 3810 was specially designed for the Asia Pacific market. It can manage up to 250 names and numbers on the SIM card and features five Asian languages plus English. There are 16 ringing tones which incorporate an escalating volume. The 3810 carries an RRP of $859 (unsubsidised).

Versatile digital lighting system

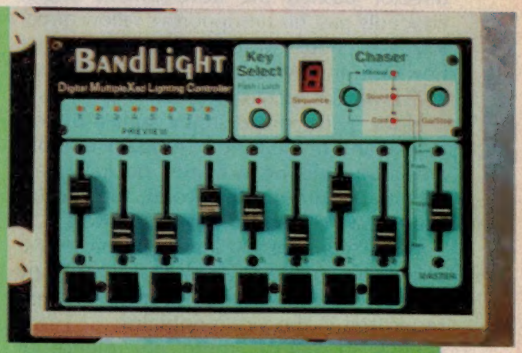
Could you use a digital multiplexed lighting effects system that does it all?

A Victorian company has produced the BandLight system, which is claimed to provide a mix of functions and features never before found in a single product. Not only that, but the product is extremely well priced, versatile, robust, very simple to use, and smaller than a single Melbourne telephone book.

According to David Gibson of Microconsultants, Bandlight is 'goof-proof' and very mobile. "Our system is perfect for small theatres, bands, discos, band rentals and schools", he said.

The system features a control desk with an eight-channel fader, a free running or sound triggered chaser, flash on-off keys, and a master fader. The desk drives up to four remote, 2400 watt four-channel power modules, allowing a total of 9600 watts of lighting. Low noise, isolated, digital control signals from the desk to the power modules can be run in a standard audio multicore cable, making setting up easy. The system can also operate various effects, such as a smoke machine or mirror ball.

Full information can be obtained by circling 140 on the reader service card or by contacting Microconsultants at 2/12 Peninsula Boulevard, Seaford 3198; telephone (03) 9773 5082 or on the Web **http://microconsultants.com**.



New Control Series speakers from JBL

Respected US speaker firm JBL has now introduced a new series of speakers for the domestic market, which it says 'breaks the established rules of home hi-fi and lets people finally take control of their every sound requirement'. The company has called its new range the Control Series, and basically they're a line of compact monitor speakers engineered for both music and movie reproduction in and outside the home. Some models are moisture, humidity, even rain resistant.

The compact size of each model and special multi-use mounting bracket supplied with the Control monitors allow convenient fixing in almost any location. The special shielding on indoor models also means they are 'television safe'.

The Control Series models are also rugged, both electrically and physically, and designed for tough treatment. Despite this they are claimed to provide exceptionally clear and powerful full-range performance. The full-range models use JBL's well-known titanium dome tweeter, while the driver handling bass and midrange in the three two-way Control models features a cone made from a poly-laminate material.

The sub6 and sub10 active subwoofers in the Control Series feature amplifiers with 60W and 100W RMS power outputs respectively.

The Control Series comprises four models of monitors and two centre channel speakers, designed to make the design ideal for use in home cinema systems. Recommended prices range from $299/pair for the Control CM40 to $699 for the Control sub10 subwoofer.

For more information circle 145 on the reader service card or contact Convoy International on Freecall 1800 251 995. ❖

Video & Audio: The Challis Report

SONY'S 'GLASSTRON' ON-HEAD MONITOR

This month our reviewer Louis Challis has been trying out an advance sample of Sony's innovative Glasstron 'MultiMedia Scope' — a head-mounted colour display which projects a large-screen 'virtual image' in front of the viewer's eyes. There's only an NTSC version of the Glasstron as yet, and it's only being sold in Japan; but we thought you'd be interested in learning what it's like. No doubt a PAL version will be available here, in the not-too-distant future...

It's now more than 25 years since Sony pioneered the development of its ubiquitous Walkman 'personal audio' systems. When Akio Morita, Sony Corporation's far-sighted director pushed the development single-handedly past his unsupportive fellow directors, few people would have realised either how fast, or how far, the 'personal electronics' revolution would progress.

Now with more than half-a-billion Walkmans, in the form of progeny or look-alikes on belts or in hands, pockets, cars and planes around the world, the revolution shows no signs of slowing down.

While you already know all that, have you ever stopped to think that what Sony did for 'personal audio' has not yet been replicated in the video domain?

Now of course there are plenty of miniature LCD TV sets, and innumerable LCD games and modules in the hands or pockets of the younger generation. The problem with those games or TV sets is the limitation imposed by the software. It is either restricted to one game, or somebody else's choice of TV programs. Even if the program is to your liking, it's unlikely that the timing will necessarily suit you.

Always the innovators, Sony decided that what it had done for audio it could probably repeat with video. What Sony developed may not necessarily have been precisely what they expected, and as always, came with some unexpected twists. The need was clearly there, as was the market demand. That demand was slated for dramatic growth following the release of the impending DVD revolution.

Supported by play stations which constituted a further market segment, Sony funded an R&D program which ultimately led to the release of the Glasstron, which is one of the most unusual products that I have been called on to review.

The Glasstron

When Sony announced the release of the Glasstron in Tokyo last June, the press release extolled its virtues. The publicists extolled 'its vivid dynamic images, which the viewer could enjoy privately without disturbing those around them'.

The appearance of the Glasstron is unusual. It consists of an unusually thick mask-like set of glasses, which are suspended from an adjustable frame which clamps onto the top of the viewer's head. The mask-like component is translucent, with a degree of transparency which is controlled electronically.

Looking at it on your head (or better, somebody else's head), you'd never guess that it contains two sub-miniature 17.5mm LCD black display panels, each of which contains 180,000 pixels. Although these panels are truly miniature, their viewed size is effectively magnified through the clever integration of reflective half mirrors and concave half mirrors, which are combined with an electronically controlled LCD shutter. (See Fig.1).

The resulting display is then projected onto a fully reflective mirror at the back of the headpiece. Whilst Fig.1 indicates that the spatial separation between the viewer's eyes and the apparent image is two metres, that is an indicated figure — which illustrates the optical magic of the Glasstron's visual display system.

In reality, the distance between the viewer's eyes and the image is only a few centimetres. But the optics artificially expand the apparent spatial separation so as to fool you into believing it is two metres, and with a display size which simulates that provided by a 130cm television set.

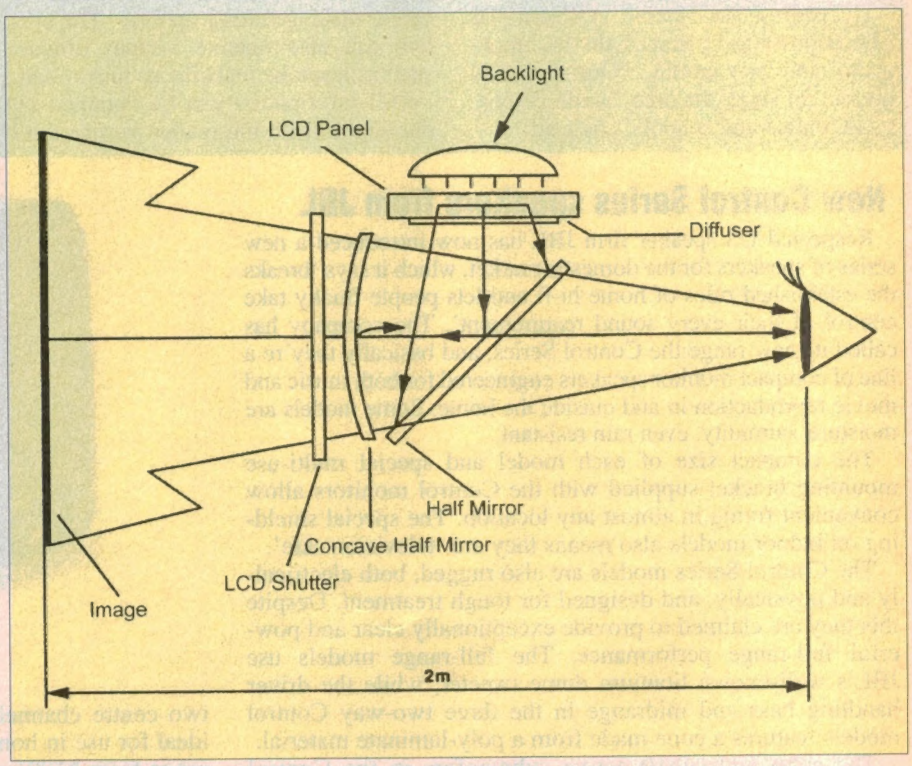


Fig.1: The otical system used in Sony's Glasstron enlarges the image from each 17.5mm LCD panel, to create a large 'virtual' image suspended about two metres before your eyes. each panel has a resolution of 180,000 pixels.

Watching a movie or a video game with the Glasstron is quite a private affair, but the impact on the viewer can be quite dramatic. The headband allows secure yet comfortable mounting on your head.

Two main components

The underlying design concept of Sony's Glasstron is radically different to what you or I might have imagined. The unit has two major components:

The first and more obvious is the functional adjustable mounted 'headband'. This provides positive and stable support for the Glasstron display unit in front of the viewer's eyes.

The second and less obvious component is the 'power box', which generates the display signal and provides additional video display and audio signal control for the head mounted display unit. The power unit also provides the critical input termination points for video, audio and external electrical power, or alternatively a potent Lithium Ion battery for portable use. With its external DC power pack connected, the Lithium Ion battery can be recharged by the power unit.

Before discussing the range of combined video/audio sources now available, it is important to consider some of the more pertinent aspects of the Glasstron's underlying design philosophy. It is apparent that in developing the Glasstron, the primary market on which the designers have focused their attention are children and teenagers.

Following Sony's release of the CD Video units in Japan, and subsequently the Sony Playstations — both of which have been aimed squarely at the teenager market — the company was ready to expand that market in preparation for its development of battery operated DVDs.

On the basis of market research, it was convinced there would be significant buyer resistance from wealthier parents, who would be the most likely source of finance for the purchase of Glasstrons. Those parents would undoubtedly wish to impose a strict time regime on the use of the Glasstron based video, or game systems.

In order to assuage the anticipated parents' fears, Sony integrated a programmable keypad with five keys, which provide a reasonably effective security code control function. At the time of purchase, the parents may thus enter the key code, and thereby limit the use of the Glasstron unit to those times, or occasions, when they are present and approve.

Supplementing the controls on the power unit, an additional small cable mounted controller has been placed in the middle of the cable which connects the display unit to the power unit. This provides the wearer with the means to electrically change the degree of transparency of the unit's liquid crystal shutter. When optimally adjusted, you have an illusionary situation where the screen appears to be hanging in free space, well displaced in excess of a metre from your head.

Whilst some of the set up controls are incorporated into the power unit, the majority of functional controls are integrated into the small cable-mounted plastic controller. In addition, an unusual sub-miniature tip, ring and sleeve socket is integrated into the module to accept a matching plug for a miniature pair of 'in ear' (or *fontopian*) headphones. This was one design feature which I had difficulty in reconciling, as I believe it would have been far simpler and more pragmatic to have integrated a set of headphones, or even extended ear pieces, into the sides of the headband. I believe that that approach offers more practical ergonomic features and advantages, when compared with the approach that Sony has adopted.

The review unit

The review unit provided to us was not equipped with its rechargeable Lithium Ion battery, which normally provides up to two hours and 20 minutes of viewing time. That time and the capacity has been deliberately selected to match the nominal maximum playing time of most DVD video discs. NTSC format DVD discs have of course been available in Japan since last December, and have more recently become available in the USA.

The review Glasstron was a Japan-market NTSC version, equipped with a 100V AC to 7.5 volt DC power pack. Whilst the voltage presented no problems, selecting appropriate software was slightly more difficult. Much to my surprise, though, Sony didn't have a DVD player available; this would clearly have been first choice.

I didn't have the cheek to ask other companies to supply their DVD players to assess a competing firm's product. In the end I decided to use a Pioneer Laserdisc player, for which a large range of excellent software is readily available. More significantly, that software includes some outstanding laser test discs, which provides a direct means to assess both the video and audio performance.

When I unpacked the Glasstron, I discovered that it is a reasonably well conceived unit with some outstanding design features. The most critical of these is the flexibility of the headband design, which ensures a stable and secure mounting of the display on your head.

As marketed, the Glasstron comes equipped with two different types of interconnection cables. These are designed to provide direct connection to either a Sony Play Station, or a conventional VCR, a Laserdisc or a DVD player, as required.

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Trying it out

I plugged the Glasstron's power pack into a 100V AC transformer, and its stereo audio/video interconnection cables into the Laserdisc player. Then I placed a Laserdisc in the player, and activated the Glasstron.

With the display unit firmly mounted on my head, I initially observed an illuminated screen on which white 'Kanji' (Japanese) text was visible on a bright blue background. Regrettably, I don't read Japanese. Only later I learnt that the display warns the viewer about a range of self-imposed viewing restrictions, and qualifications relating to the adaptability, and safe use of the Glasstron.

In the absence of an English handbook, and with considerable good fortune, I pressed the correct button on the cord and advanced to a different set of text. Pressing the button yet again, I was presented with a darkened display on which there was a horizontal white line, with three crossed short vertical bars superimposed.

Closing my right eye, I saw only the horizontal line. When I closed my left eye, I saw only the three short spaced vertical lines. Although I didn't know it at that time, I had correctly interpreted the test procedures through which it is intended that the viewer check out his (or her) suitability for viewing the Glasstron display. In the event that the viewer is unable to optimally align the display, the Japanese instructions exhort the viewer to take the unit back to the shop from which it was purchased.

I pressed the control button yet again, and I was viewing the video signal provided by the Laserdisc player. With the two ear pieces correctly inserted into my outer ear canals, I had a good picture and full stereo sound.

BIG pic, but good

The first thing I observed, that the outer edges of the picture were outside the range of my vision, and even when the display was readjusted, other sections of the display were out of view. Other members of my family experienced the same problem.

I adjusted the rotary video contrast control and hey presto! I had an excellent picture.

The disc I chose to initially view was a 'Reference Recording Video Standard Disc' (LD 101). Whilst the picture was by no means up to the standard of my Sony Profeel Monitor, it was nonetheless reasonably good. The colour balance was excellent, and by using the appropriate clips from the 'Reference Recording Test Disc', I was able to confirm that I had somewhere between 340 to 360 lines of horizontal resolution, and just over 300 lines of vertical resolution.

I checked out the audio bandwidth, and considering I was using the miniature 'in ear' earpieces, I still had a bandwidth of better than 30Hz to 10kHz (+/-10dB). Clearly, the designers had taken the appropriate trouble to ensure that the main performance parameters are good.

In a short space of time, I was so entranced by the video that I found it difficult to be deterred by minor limitations in the video optical system performance.

At that point, I applied a temporary halt to my activities, and placed business before pleasure. I used the wide range of special video test patterns that the 'Reference Recording Test Disc' provides to confirm the Glasstron's major features.

Summarising...

Once correctly adjusted, the Glasstron provides a good (but by no means an outstanding) video signal. It is however considerably better than what I have come to expect from portable battery operated, pocket sized LCD TV sets.

The Glasstron happily displays a 16:9 letterbox format video signal. Best of all, it provides the ability to selfishly pander to your personal taste with either a video, or game without disturbing others. It should be noted that wearing glasses does not constitute an impediment, and there is sufficient clearance between the face of the Glasstron and your head to comfortably accommodate glasses.

Sony have not yet released a PAL version of the Glasstron. At this point of time, they are not even marketing the compatible NTSC version of the unit in America. Don't be disheartened, though — sometime in the not too distant future they'll do both.

By the time they do, I expect that they will have optimally adjusted the headband sizes to suit the different physiological features found in Australia.

If they simultaneously resolve the minor limitations imposed by the current earpieces and connect them directly to the headband, I am sure they will have a winner on their hands.

The problem will undoubtedly be that parents will not wish their children to use them — because they'll want to use them themselves. ❖

Sony PLM-50 Glasstron 'MultiMedia Scope'

A head-mounted video monitor, providing a large colour 'virtual image' floating in space a couple of metres in front of the viewer. Display unit measures 200 x 120 x 260mm; accompanying power box measures 51 x 41 x 139mm.

Good Points: Good quality image, well balanced in terms of colour rendition. Excellent for private viewing, yet gives 'big screen' impact...

Bad Points: As yet, only sold in Japan (NTSC version, as tested). Currently earpieces are separate and not integrated with the head-mounted display. Image can extend beyond range of vision.

RRP: Not available here as yet. Price of NTSC version sold in Japan roughly equivalent to A$1050.

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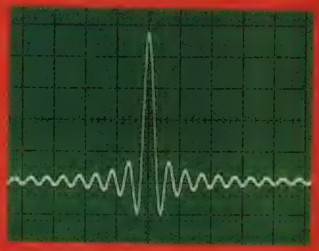

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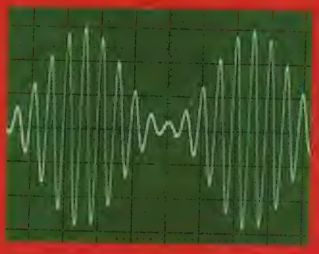

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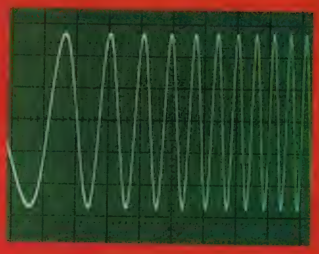

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DIGITAL EDITING WITH THE APPLE/AVID 'VES'

Video editing systems based on personal computers have been around for a while, although setting up such a system has generally been pretty complex — and expensive. But Apple Computer and Avid have now put their hi-tech heads together and come up with the Video Editing System, an integrated and easy to use non-linear video editing system for the pro and the dabbler alike. Barrie Smith has been trying one out...

by BARRIE SMITH

I'd like a dollar for every film and video editing device that I've set my knees beneath and my eyes upon. There's been muttering Moviolas, spinning Steenbeck editing tables, bewildering Betacam systems and of course, the latest — Avid and Media 100 digital editing suites.

But these have all been pro, high end editing equipment for 16mm and 35mm film and 1/2" Betacam tapes. What about the amateur video maker, battling with VHS, Video 8 and the new DVC digital camera format? What has the keen amateur been using to edit tape?

A range of options has been around for a while, beginning with itchy trigger fingers, keen reflexes, a combination of replay and record machines to perform simple assembly edits — leading right up to complex computer-based solutions requiring dedicated software, video in/output cards and tons of mucking around.

Now in my book many of the latter are fine — *if* you are computer wise and are prepared to make plenty of ill-advised buying decisions, followed up by re-investment. But few consumer computer editing systems are 'systems' — one package of hardware and software, devised by the one manufacturer and designed to operate harmoniously.

Apple and Avid's answer to this problem is the Video Editing System or 'VES'.

Promises...

With the VES approach it's claimed you can edit 'straight out of the box'. For the purposes of the review, Apple provided me with a Macintosh Performa 6400 200MHz tower unit, strapped with 24MB of RAM and a 2.4GB hard drive. Avid's Cinema software is supplied on CD-ROM, while the video card that would do all the hard work is pre-installed.

A Mac Performa, as used in the review. With imported video clips consuming 55MB per minute, a big hard drive is obviously the go for this kind of work!

The rear of the CPU was densely populated with video and audio inputs and outputs. Camcorder (or VCR) video signals are accepted in composite form (RCA inputs) or S-video via the usual four-pin connector, while the audio (L+R) information is taken in via RCA inputs. When outputting the edited material to a VCR or TV you again have the choice of RCA and S-video connectors.

In working with moving images and sound you can use the usual monitor (in my case a 15" AV unit) connected, or hook up a TV of any size to the computer's video and audio outputs. At the time I had a 70cm set patched in — a luxurious way to edit video!

Due process

It was time to fire up the Avid Cinema software. The on-screen display resembles a collection of filing cards, indicating the post-production stages you face: Storyboard, Bring Video In, Edit Movie, Effects, Titles, Sound and Send Movie Out.

The lucid manual advises novice editors to access the Storyboard mode. When you do so, and up comes a display. On the left side is shown your various video clips, with the right carrying descriptive text. This approach is possibly more suited to someone planning to shoot a movie — or for those who intend to edit in a structured fashion. I come from the 'bash and crash' school, having shot enough movies to do most edits in the camera, then planning the final edit by repeated previews of the virgin footage.

Next step is Bring Video In — into the Mac, that is. Once you've selected the video source (composite, S-video, etc.) you simply run the replay source (camcorder, VCR etc) and a quarter-

Home video making has become a popular family activity. Maybe with such systems as the Apple/Avid VES, home editing may follow.

screen display of the action appears on screen; at the same time stereo audio issues forth from the Mac's speakers. It's as simple as that.

Interestingly, the S-video input is processed in Motion JPEG and takes account of the separate chroma and luminance signals — so effectively, the data when digitised is different from an incoming composite signal. At the end of the process a true S-video signal is output again.

The codec used was Motion JPEG, because it allowed single frame edits to be accomplished — unlike MPEG1, which relies on interframe compression.

VES' Motion JPEG relies on *intraframe* compression, so occasionally you see artefacts such as aliasing on straight lines. But for the most part, the quality exceeds that of a VHS to VHS dub. But we are ahead of ourselves...

Press an on-screen Record button and you're away. Finished dubbing the action? Press Stop. Below the action display now appears your video clip (and sound) as an extended bar on a timeline, next to a dinky icon of a camcorder. A thin purple strip at the lower edge of the video clip's bar indicates the presence of original sound; if you prefer (and often a camcorder's audio pickup is only annoying ambience) it can be deleted. Below the camcorder timeline are ranged three more: titles, narration, music/effects — and each can be moved anywhere.

Avid suggest that you transfer your video clips as separate scenes, stop/starting the replay camcorder or VCR when 'OK' takes roll up on the tape. This approach withholds unwanted material and helps keep the clip file sizes down.

The Avid Cinema approach to editing is non-destructive; if, in the editing process, you remove action at the head or foot of a scene in your edit, the original material remains (unseen) on your hard drive. This approach makes sound sense — although you have to have a massive hard drive, as five minutes of video and sound will occupy 275MB of storage. That's five minutes of original uncut material — so, if you have ambitions of editing a half hour of tape down to a tight five-minute final edit, look forward to the system gobbling up 1650MB of drive real estate!

The Avid Cinema ID logo.

Other material required to construct a polished 'movie-mit-sound' demands extra hard drive storage. This may consist of narration or music (five mins = 53MB), sound effects (30 secs = 23MB). Of course, the final edited movie data must also be accommodated, with five minutes of the final edit requiring a further 375MB.

A quick calculation tells me our finally edited five-minute movie, with say 25% narration, a dash of sound effects and let's say 50% incidental music could quickly eat up 400-500MB.

One saving grace is that if a scene is repeated, the file is not duplicated — only its edit 'marker'.

Cut and polish

So we've copied all the footage we need. Let's do a cut. By now we have a number of separate clips on the timeline. Clicking the on-screen PLAY button will deliver a preview of the dubbed footage, with all the separate scenes smoothly running in sequence. And this

The introductory storyboard display in Avid Cinema.

is the trick to it: if the separate clips abut each other, they will simply cut from clip to clip, on screen. Move one away from its neighbour and black will appear between. Move the last clip along the timeline and insert it between clips 2 and 4 — then scene 6 becomes scene 3. You've just made an edit!

Run the assembled sequence and the progress is: scenes 1, 2, 6, 3, 4, 5, etc. The wise ones call it 'non-linear' editing.

You can move any scene to any spot on the timeline; the preceding and succeeding scenes shuffle down and retain replay order. If you were editing on a *linear* system (such as a Betacam edit controller) and you needed to move a scene out of sequence, you would have to redub all the scenes after the edit point.

Old-time editors dealing with brimming baskets full of separate film clips had the wonderful freedom of being able to drop a scene into the final cut at any point, needing only to remake a cement splice or two. Without knowing it, they were engaging in non-linear editing.

Like to trim a clip's top and tail? If you select it, 'grab handles' appear at each end; push or pull one handle and the work screen shows the action as you run past it. Stop on one frame and that's your new edit point. Frame accurate! I worked with some old tape from one of my pro productions, with display SMPTE time code on the VHS tape, and was delighted at the ease with which I could perform frame accurate edits...

An interesting function is 'Split Clip'. This allows you to cut into a clip anywhere, thereby making two scenes out of one. It comes in very handy when you want to move things around in extravagant fashion!

Like to dissolve between scenes? Move to the Effects mode, select Dissolve from the list (there's also Book Turns, Barndoor wipes, etc. etc.,), decide on the length of it — and simply Apply.

Titling is another 'post' chore the keen editor will want to pursue. Go to Titles mode and once the specific clip — or interval of black is selected — you type in the title text, choose its alignment (centre, top etc), font and size, colour, whether you want it to scroll in from the side, top or whatever. Click on Apply and the title appears as a clip on the timeline dedicated to titling. At this stage you can reposition the title clip relative to the main action video clip and super the title over any part of any scene...

The display in Edit mode. Note the timeline and components for picture editing, titling and sound mixing, at the bottom.

The sound side

Time for music? And effects and voice? Here the possibilities explode. You can record a live voice as you run the final edit, drop in a slice of prerecorded narrative, cue in sound effects (a library of various effects is provided) or run background music (acquired from CD or an external tape recorder) as well as importing AIFF or (Mac) SND audio files.

Now you may think this is the end of it. But you only have an edited and sound embellished movie — on the computer. Run it and you'll see what happens as you witness effects such as wipes and dissolves — and watch out for the scrolling titles! Because you have assembled the movie in RAM and disk, and the computer has to deliver it to the monitor from this source, effects and titles demand massive amounts of processing power — so the image stunts and halts when these sections are encountered.

But surely you want to view your cre-

Titling is a simple task, but final compilation can eat up large amounts of time. Note the pink clip on the second level of the timeline, indicating the presence of the title data as a scene.

ation in all its consecutive glory. So you must Send Movie Out. Hook up the outputs to a VCR and TV, start the tape, then click Make Videotape — and off she goes, dubbing image and soundtracks in real time. The computer monitor will give you a real time, full screen smoothly flowing view of the process.

And there you have it, an edited VHS tape of your final edit. It's that simple.

And the quality?

The end result is surprisingly good. I have seen (and made, to my shame) far worse VHS to VHS copies using a pair of VCRs. With Avid Cinema-made tapes you don't see excess colour shifts evident in the latter process, nor losses of definition — and of course, the sound is identical to the original, having been handled in a digital domain.

What you *do* see is occasional instability of verticals and aliasing of horizontals, presumably products of the compression process. But you also see perfect titles and beautifully timed, exquisite visual effects.

For anyone needing a post-production answer for consumer level video, this has to be the answer. And it would be invaluable for the pro wanting to make a trial edit on a production, to show the client — complete with voice, music, effects.

Other points we can make are:

- You can save movies to videotape or as QuickTime files optimised for presentations, World Wide Web sites or Internet exchange.
- Motion JPEG compression and decompression is employed, so allowing frame accurate edits.
- Up to 30-frames-per-second (fps) Motion JPEG compression/decompression at 320 by 240 pixels.
- Vertical and horizontal interpolation and filtering for high-quality output of up to 640 by 480 pixels.

The Apple Video System is bundled with PowerPC processor-based Mac models having a PCI expansion slot (such as the 5500 or 6400 series). The price is around $4700 (ex monitor).

The software/card Avid Cinema package (RRP $995) can be purchased and installed in a Mac with built-in composite or S-video input and a PCI expansion slot (such as the 7500, 7600, or 8600 series), 24MB of RAM, Macintosh system software version 7.5.3 or later. ❖

Apple/Avid Cinema VES

A non-linear AV editing system based on a Macintosh personal computer.

Good points: Comes as an integrated hardware and software system, to simplify setup. Easy to use, capable of impressive video manipulation. Motion JPEG encoding allows frame-accurate editing.

Bad points: Limited to VGA image resolution (640 x 480 pixels). Processing time increases significantly with overlaid titles.

RRP: Video card & software $995, computer around $4700 less monitor.

Further Information: Apple Computer Australia, 16 Rodborough Rd., Frenchs Forest 2986. Freecall 1800 025 355.

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READER INFO NO.4

BAYGEN'S FREEPLAY: A WIND-UP RADIO!

Manufactured in South Africa, the Baygen 'Freeplay' wind-up radio has attracted a lot of attention around the world because of its obvious benefits to people in developing countries. It's now available here in Australia, from Dick Smith Electronics stores.

by JIM ROWE

You've probably heard of the Baygen Freeplay; it was the subject of a TV documentary and articles in various overseas magazines, a year or two ago. British businessman Trevor Baylis came up with the idea after visiting remote areas in Africa; he saw that it would be a tremendous step forward for people in developing countries to have radio communications, but realised that in many cases providing power on a day-to-day basis for even a small transistor radio would present insurmountable problems. Even when batteries were available, they were too costly.

Surely it would be possible, he reasoned, to produce a radio powered by a hand-wound spring motor (an updated version of the kind used in clocks and early gramophones) to drive a small DC generator? On his return to the UK, developing such a radio became his mission. He obtained development funding from the British Overseas Development Administration, and assistance from engineers and designers in both Europe and the USA. Soon the first prototypes were produced, to prove the idea, and Mr Baylis also found investors to set up a manufacturing plant in South Africa — to provide much needed jobs as well as radios.

Since then the Baygen project has apparently gone from strength to strength. The factory set up near Cape Town to produce the radios has deliberately been organised with 60% of its staff drawn from organisations for the disabled, and is producing around 500,000 radios per year.

The Freeplay radio has been endorsed by over 20 international and humanitarian organisations, ranging from the Red Cross to the United Nations. Crown Agents in the UK have ordered 60,000 units, and companies in over a dozen countries worldwide have applied to manufacture the radio under licence.

Of course the Freeplay is mainly intended for people in developing countries, to provide a way for them to keep in touch with events in their own country and the rest of the world, with virtually zero running costs. However since it uses no energy apart from 'muscle power', it's also an outstanding example of environmentally friendly technology. There's also the advantage that it can be taken on holidays or trips to remote areas, without any worry about batteries suddenly becoming flat at an awkward moment.

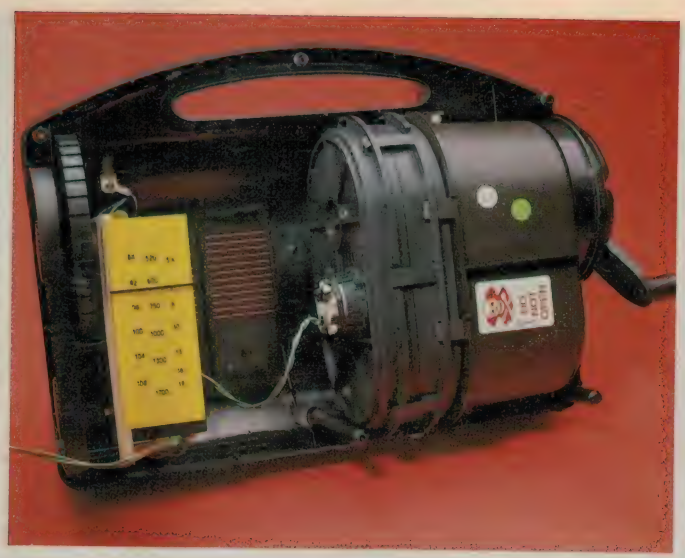
These features, along with the novelty factor, have made the Freeplay very popular in developed countries as well — at least when supplies have been made available, as has now happened here in Australia. And presumably the Baygen organisation doesn't mind selling some of the radios in developed countries, because it keeps the factory busy and probably also provides a certain degree of subsidisation, to allow the radios to be kept affordable by those in its primary markets.

In Australia the Freeplay is now available via the Dick Smith Electronics chain, for $149.00.

What it's like

So what is this genuine latter-day clockwork radio like? As you can see from the main photo, it looks a bit like one of the valve portables of the 1960's, and is about the same size and weight. It measures 345 x 245 x 141mm, and weighs in at a fairly hefty 2.8kg.

Needless to say, the receiver section of the 'works' accounts for very little of that size and weight. At least half of the bulk, and somewhat more of the weight, is contributed by the spring motor and generator module — as you can see from the internal photo. The generator itself is visible at the 'inner' end of the module, with its wires leading to the radio section.Interestingly, in contrast with old-type spring motors which generally had a very solid metal frame, the



As you can see, the spring motor-gearbox-generator module takes up a good half of the volume inside the case. The radio operates for about 40 minutes from a full wind of the spring.

frame of this spring motor/generator module is made from moulded plastic. The spring motor itself apparently uses a carbon-steel spring, and is of the 'B' wound configuration for high energy storage capacity.

The generator is integrated with the motor in the module, together with what is apparently a three-stage gearbox. To be honest we didn't try to look inside the module, because husky spring motors can be fairly dangerous — as you can see, there's a label on the module warning against opening it. (I remember slicing my finger open fairly deeply as a kid, trying to dismantle an old gramophone motor!)

The spring motor/generator module in the Freeplay can be fully wound comfortably in about a minute (about 58 turns of the handle), and will then run the radio for about 40 minutes. The small generator seems to produce a fairly constant 3V DC, and happily supplies the approximately 30-50mA required by the radio.

The radio section of the set is essentially all built into the end of the case at the opposite end from the spring motor. It's a reasonably basic but sensitive three-band superhet design, tuning the medium wave band from 520 - 1600kHz, the shortwave bands from 5.8 - 18MHz, and the FM band from 88 - 108MHz. As usual medium wave reception is via an inbuilt ferrite rod antenna, with the other two bands using a telescopic rod.

The tuning dial is of the vertical linear type, and of a reasonable size. The main tuning knob is quite large, and effectively 'two in one': the hub protrudes through the end of the case for rapid tuning, while its rim protrudes through a slot at the side, for fine tuning. A very practical arrangement...

The speaker is a sturdy 89mm (3.5") type, mounted behind the front panel. This and the available volume inside the case gives the Freeplay a well-rounded and satisfying acoustic output, despite its modest electrical output capability.

In use, the Freeplay gave a good account of itself. The radio performs quite well, and there's really no problem in having to rewind the spring every 40 minutes or so. The spring motor produces an occasional small thudding noise as it unwinds, especially when it's nearing the end of the wind, but this doesn't detract significantly from the reception.

In short, our reaction is that the Baygen Freeplay is both a novel idea, and also quite well made. It's not exactly cheap as transistor radios go, but on the other hand it's likely to give you reception for many years with zero running costs. You can feel virtuous as well, for both helping provide practical radios to developing countries, and also not polluting the environment with dead batteries. ❖

Baygen FreePlay

A three band (AM/FM/shortwave) transistor radio powered via a 'wind-up' clockwork spring motor, driving a small DC generator.

Good points: Zero running costs — you provide the power. Excellent for developing countries, remote areas. Environmentally 'clean'. The receiver is quite sensitive and provides good tone.

Bad points: Not cheap, but you're helping to support a worthy cause. Spring motor makes the occasional thud.

RRP: $149.00

Available: Dick Smith Electronics stores. DSE will also deliver to your door if you order via 1300 366 644.

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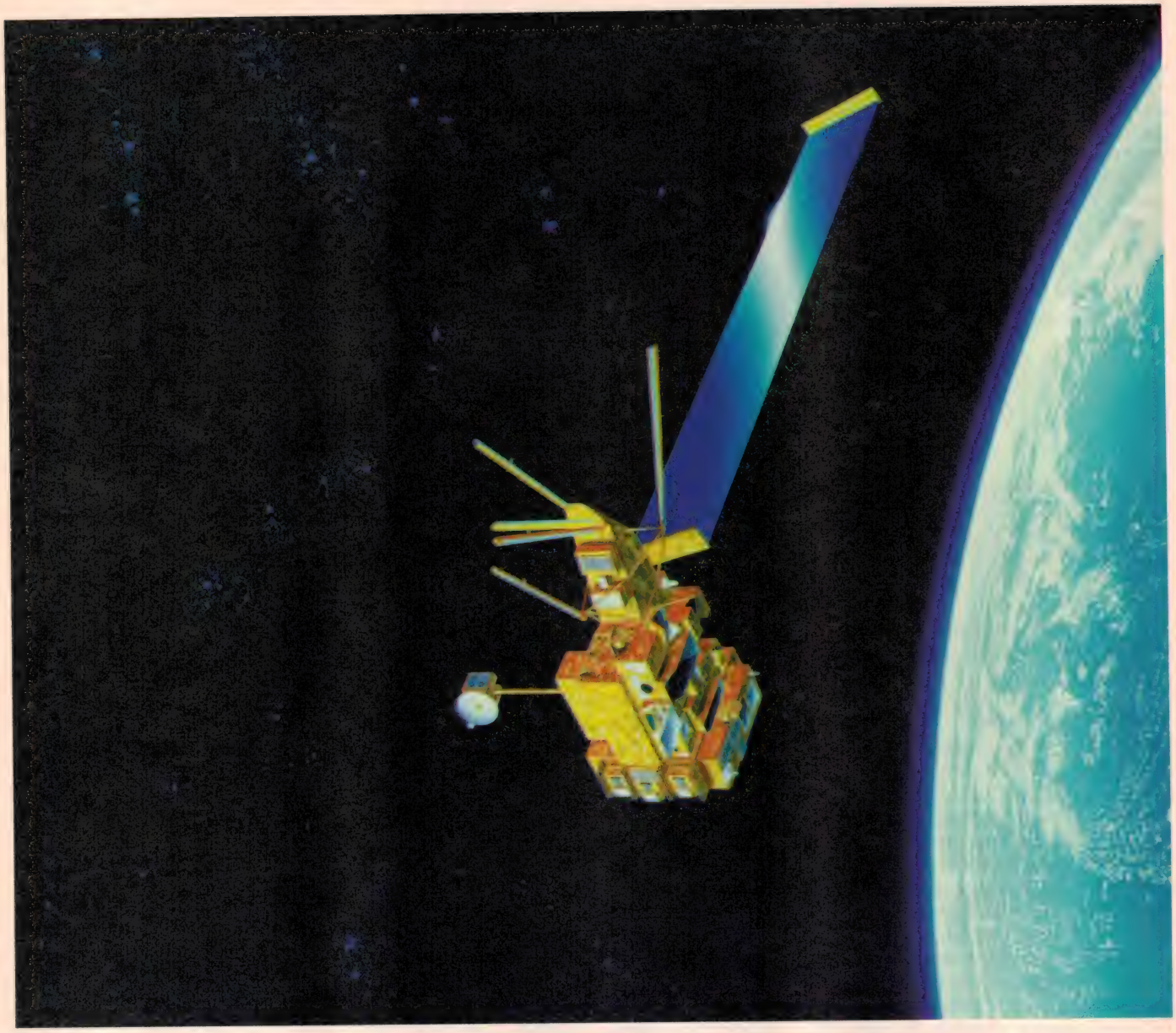
READER INFO NO.5



INSTRUMENTS ON ADEOS GIVING EARTH A 'PHYSICAL'

Japan's new Advanced Earth Observing Satellite is the latest addition to the flotilla of orbiting 'birds' training their scientific instruments back at Earth, rather than neighbouring planets. In this case it's carrying a raft of new instruments, designed to help our understanding of exactly what human industry and commerce is doing to our planet — and hopefully help find answers.

by GEOFF McNAMARA

The technology that has provided us with close-up pictures and other data of the distant planets of our solar system is undeniably spectacular. The result is an ever-improving knowledge of worlds other than our own. But with an increasing list of potential global catastrophes facing our own world, this same technology has now been turned on Earth. In an attempt to understand the Earth as a planet, spacecraft have been placed into Earth orbit looking down with eyes sensitive to a wide range of the electromagnetic spectrum.

The latest addition to this flotilla of

Earth explorers is also the most elaborate and advanced. Appropriately called the Advanced Earth Observing Satellite, or 'ADEOS' (and I apologise in advance for the number of acronyms used in this article), this Japanese spacecraft carries an impressive arsenal of international instruments that is giving the Earth a comprehensive and long-overdue stocktake.

The driving force behind ADEOS is Japan's National Space Development Agency (NASDA). With a primary objective to monitor changes in the Earth's atmosphere and on the surface, NASDA contributed two core instruments, while so-called 'announcement of opportunity' instruments were contributed by NASA, the French space agency CNES, Japan's Ministry of International Trade and Industries and the Environment Agency of Japan.

ADEOS is a 3.5-tonne spacecraft as big as a caravan and capable of generating 4.5kW of power. By the time the 3m x 24m solar array is deployed, the spacecraft measures some 11 x 29 metres. This is a large satellite!

ADEOS is made up of two main components: the mission module, which carries the scientific instruments, and the bus module which carries the support subsystems. By having the instruments thermally, mechanically and electrically independent of one another, integration and testing was made easier and faster.

Hi-res viewing

One of the two core instruments, the Advanced Visible and Near-Infrared Radiometer (AVNIR) has been designed to observe land and coastal regions in the visible and near-infrared bands of the spectrum. The instrument consists of a Catadioptric Schmidt optical system which gives minimal aberrations over the 5.7° field of view. The telescope's mirrors are made from low expansion materials that weigh up to 70% less than conventional mirrors.

AVNIR looks at an 80km wide swath of the surface as the satellite orbits the Earth. Depending on the spectral band used, linear-array CCDs with 5000 and 10,000 pixels allow a high resolution of 16 or eight metres. The 80km by 8m strips are combined to provide detailed images of the Earth's surface. The resulting data is then compressed by 10% prior to transmission to ground stations.

The second core instrument is the Ocean Color and Temperature Scanner (OCTS), an optical radiometer designed to measure ocean 'colour' to study chlorophyll, and thermal emission to monitor temperature of the oceans. This information can be used to keep tabs on the amount of chlorophyll and dissolved substances in the water, and for determining primary production in the ocean and studying the carbon cycle.

OCTS achieves a highly sensitive measurement of ocean colour and temperature, using eight visible and four thermal spectral bands. Because it measures the temperature along a 1400km wide swath, OCTS is able to measure the same area on the surface every three days, which means short-term changes in temperature and other phenomena can be monitored in detail.

Six smaller instruments complement the data collected by AVNIR and OCTS. NASA contributed an instrument known as NSCAT — for NASA Scatterometer — which provides information on the wind speed and direction over the Earth's oceans. This is valuable data since, while such information is regularly gathered by ground stations over the continents, aside from the occasional (and often unreliable) reports contributed by ships at sea, little is known about wind currents over the oceans. With three quarters of the Earth covered by water, NSCAT data will play a major role in helping to understand global wind currents.

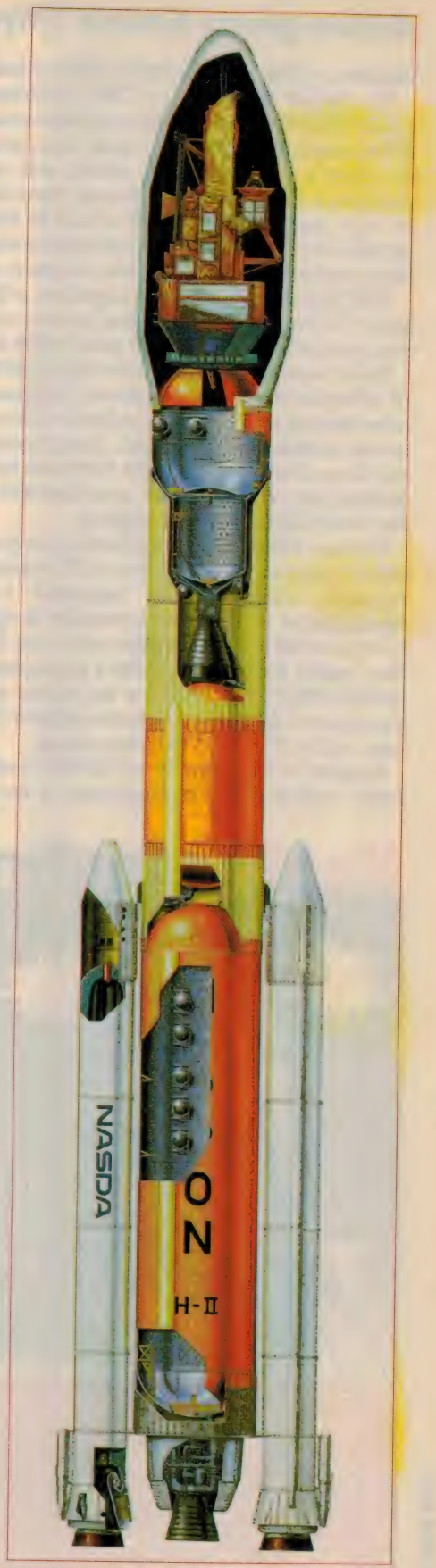
NSCAT works on the principle of reflection of microwaves off the ocean's waves. An array of six 3m-long antennas radiate 14GHz microwave pulses towards the surface. Two 600km wide swaths separated by 330km are scanned. The ocean waves, or more correctly 'roughness', present at the time results from the prevailing wind conditions. The reflected radar cross section therefore provides information on ocean wind speed and direction.

Since NSCAT makes 190,000 measurements each day, the result is 100 times more data than has ever before been gathered. Such data should improve our ability to forecast weather, and help us understand global phenomena such as El Niño.

Ozone layer

Prominent in southern hemisphere countries' media is the hole in the ozone layer. This environmental hazard is the target of the Total Ozone Mapping Spectrometer (TOMS). TOMS monitors the amount of ozone in the atmosphere by comparing the albedo, or reflectivity, of the atmosphere in three pairs of spectral bands, with the reflectivity of the Earth's surface at a longer wavelength which is unaffected by the atmosphere.

In addition to ozone, TOMS is also able to monitor the amount of sulphur dioxide in the atmosphere, which is an indication of volcanic activity on the Earth's surface. This information is valuable since it is expected that eruptions such as Mount



ADEOS was launched into orbit via an H-11 vehicle, from Tanegashima Space Center in Japan.

Adeos giving Earth a 'Physical'

Pinatubo in June 1991 are likely to have climatic effects.

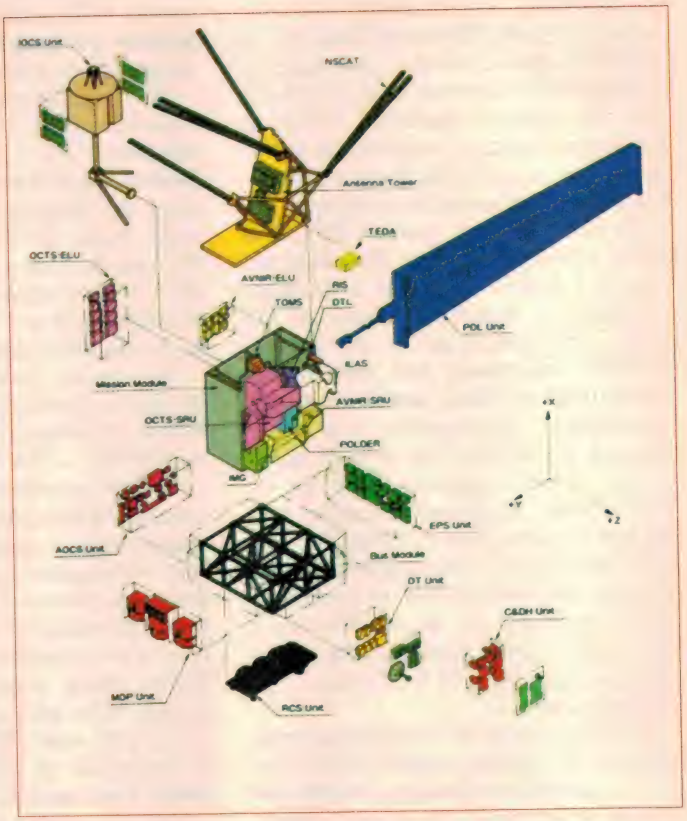
The French space agency CNES contributed an instrument called POLDER — Polarization and Directionality of the Earth's Reflectances. POLDER looks at the way sunlight is reflected off the Earth's surface, oceans, clouds and aerosols. POLDER researchers are investigating several phenomena, ranging from the way aerosols interact with clouds to influence the Earth's greenhouse effect, to the way vegetation on land and in the oceans helps maintain the level of carbon dioxide in the oceans.

POLDER consists of a wide-angle lens, a filter/polariser wheel and a CCD array. The filter wheel permits scanning in eight narrow spectral bands and at three polarisation angles.

While most of the instruments aboard ADEOS are collectors of information, the Retroreflector In Space (RIS) is nothing more than an open box with reflective inner surfaces mounted on one corner of the spacecraft. Lasers aimed toward the satellite from observatories on the Earth are reflected by RIS. By studying the reflected beam, scientists will be able to monitor the composition of the atmosphere.

Because ADEOS orbits the Earth from pole to pole, it experiences a sunrise and sunset every 101 minutes. Watching these romantic scenes is the Improved Limb Atmospheric Spectrometer, or ILAS, an instrument designed to monitor the level of ozone in the atmosphere above the Earth's poles. As the Sun 'passes through' the Earth's atmosphere, as seen from on board ADEOS, ILAS looks at the known spectral properties of the centre of the Sun's disk in the infrared (1610 to 850nm) and near visible (781 to 753nm) wavebands.

Because of the geometry of ADEOS's orbit, ILAS is able to make vertical profile measurements of the Earth's atmosphere above high latitudes. In addition to monitoring the ozone content, ILAS also measures related substances and temperature and pressure.



ADEOS is quite a large satellite, measuring 4x4x7m before the 3x24m solar array panel is deployed. Most of the main parts and instruments are identified here. (Photo and diagram courtesy NASDA)

Finally, the greenhouse effect is now under scrutiny from ADEOS using the Interferometric Monitor for Greenhouse Gases (IMG). While it's understood which gases are causing the greenhouse effect, and that these gases are largely produced by human activities, the precise sources and how serious they are remains uncertain. There are two main sources that IMG is searching for: deforestation and biomass burning. It is IMG's task to locate and measure these sources by monitoring the global and regional variation of trace gases.

IMG is a Michelson Fourier Transform Spectrometer that uses two mirrors and a beam splitter. One of the mirrors is fixed, while the other travels along a 10cm track on magnetic bearings. By varying the relative positions of the two mirrors, an interference pattern is produced. The interferogram produced is Fourier transformed to obtain a spectrum.

These eight instruments are currently observing the Earth's surface, providing us with a comprehensive assessment of our planet's current environmental status. The ADEOS mission will take three years, at the end of which scientists should be in a much better position to assess just what effect we are having on the Earth's environmental system, and how to repair the damage.

Geoff McNamara is a freelance science writer based in Sydney, and a regular contributor to EA. He extends thanks to Michael Box from the University of New South Wales, and Hideo Hasegawa from NASDA, for their help in preparing this article. ❖

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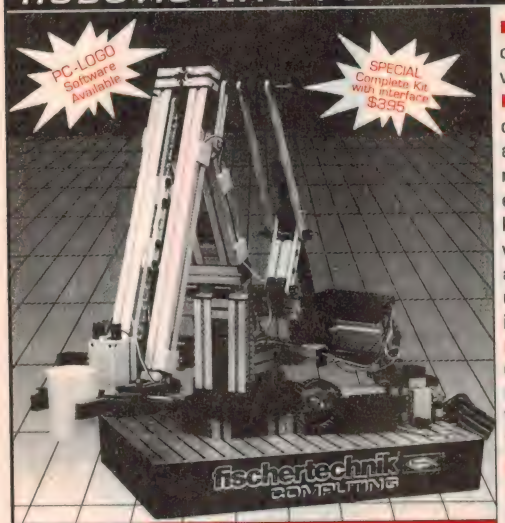

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READER INFO NO.6

MEMO

To: Jim Rowe
From: Gary Johnston & the rest of the Jaycar crew

Dear Jim,

Please accept our best wishes for the celebration of 75 years of electronics publishing. I have been a continuous reader since 1962. Indeed, Electronics Australia (or Radio, TV and Hobbies as it was known then) was a seminal influence in my decision to make a career in electronics. Like many others here at Jaycar I turned a great hobby into a great career!

So thanks, to you and your staff from all of us here for producing a really good read month after month, year after year.

Kind regards
Gary Johnston.

Jaycar ELECTRONICS

READER INFO NO.7

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READER INFO NO.8

Product review:

VELLEMAN LCD HANDHELD SCOPE

Priced at just $449, the Velleman LCD portable scope makes this type of handheld instrument affordable for hobbyists and service technicians on a tight budget. It's limited to frequencies below 500kHz, but offers a range of practical features such as true-RMS voltage measurement, a marker-based time and frequency readout, an 'intelligent' auto-ranging mode, plus built-in test tone and PC data link facilities.

by ROB EVANS

Regular readers of *Electronics Australia* will probably have noticed a number of recent reviews of LCD-based portable instruments from well-known instrument manufacturers such as Fluke, Tek and HP. If you're like us, you would have found both their features and performance very impressive indeed for such compact instruments — but from a non-professional or hobbyist point of view, really had to put them on the 'when I win the lottery' shopping list, despite their competitive prices.

On the other hand, if you don't *really* need the high-end features and performance offered by these devices, the idea of a low cost portable LCD-based instrument with a limited bandwidth may be appealing.

Clearly, Belgium-based manufacturer Velleman Components has seen a market niche here and responded with its HHS5 digital Handheld Scope, a compact LCD oscilloscope offering a maximum sampling rate of 5MS/s and a wider range of features than a comparable benchtop scope. The HHS5 is available from Jaycar stores throughout Australia for just $449 (not including accessories), and at that price appears to be in a league of its own in the handheld scope arena.

Of course what you don't get for that price is the very high performance electronics and extremely rugged construction of the big-name handheld scopes. But on the other hand, you don't get the four-digit price tag either...

In practice the Velleman HHS5 can display repetitive signals up to around 500kHz (at an effective sampling rate of 5MS/s) and single-event signals of up to about 100kHz (at 0.5MS/s), with the usual 8-bit resolution. Other than that, it offers a standard 1MΩ/20pF input, an A/D converter accuracy of +/-2 bits, and a maximum input voltage of 100V peak — or 600V with an x10 attenuating probe. This and the fact that the HHS5 also has a built-in (variable output) sinewave generator makes the instrument quite suitable for a wide range of both hobbyist and semi-professional field work, where a portable but low-cost handheld scope is needed.

The HHS5 measures 230 x 130 x 43mm, weighs around 600g (without batteries), and has a slightly unusual T-shaped case with a 64 x 128 pixel LCD readout occupying the upper section plus an array of 16 'bubble' pushbuttons taking up the lower area. The buttons control the usual range of digital scope functions (scaling, trigger levels, hold, and so on), while many have double functions that are activated when the unit is in a particular operating mode.

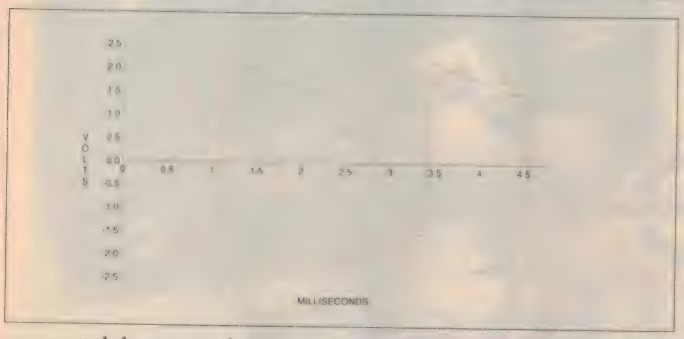
The LCD itself has its far right-hand section assigned as a settings and data readout area, while the displayed waveform appears in the remaining region with a vertical resolution of six bits — which is all you can get from 64 pixels, of course. While the limited LCD resolution is probably one of the significant cost-saving compromises used by the Velleman designers for the HHS5, we couldn't help but feel that this really does limit the instrument's practical resolution/accuracy, and therefore usefulness. It's doubly taunting when you consider that the unit actually stores the full eight bits of data for each sample.

Nevertheless, when we installed a charged set of six NiCad batteries in the unit and performed a series of test measurements, we found that the Handheld Scope's display delivered sufficient resolution for most adjustment and monitoring jobs typically found in a hobbyist or field environment.

This was helped to large degree by the (full eight-bit resolution) measurement data appearing in the right-hand section of the display, which can be configured to read the waveform level in peak or true-RMS voltage, or in decibels (0dB = 0.775V). DC measurement with a variable zero-set function is also avail-

able, and one particular screen mode offers a set of four adjustable marker lines (two horizontal and two vertical) with matching data readouts supplying voltage, time and frequency data.

The other way the Handheld Scope's full vertical resolution can be realised is through its pseudo-RS232 PC upload link, which transmits all 96 8-bit waveform samples via a 3.5mm phono socket in the top of the unit, each time the instrument is turned on. With a special phono plug-to-DB9/25 serial adaptor lead (a wiring diagram is included in the manual) connected between the scope and a host PC, the computer can then be used to process and display the full 8-bit data in any convenient form — usually as a spreadsheet-derived waveform, as shown here.



This is a rather fiddly process in practice, since some kind of terminal program needs to be running on the PC in the correct configuration (9600b/s, N-8-1 format) to first capture the data, then a spreadsheet or similar used to turn that stored information into a usable format. And as this (last displayed) data is only transmitted each time the Handheld Scope is powered on, it's hardly a 'real-time' operation...

In any case though, the ability to pass waveform data to a PC is a valuable asset, and the process could certainly be automated to some degree through some form of program scripting, or even with custom-built software. An example of this is a small program available for downloading from Velleman's own internet Web page, which is a complete interface, storing and displaying package for the HHS5 — see the example screen shot shown here.

Called (not surprisingly) 'Handheld Scope' the software is written for Windows 95, and for those that do not have access to the internet, is now available for downloading on our bulletin board system (BBS). Phone (02) 353 0627 to connect with the EA BBS, and look for HHS5.ZIP in the Technical Software file area (number 170).

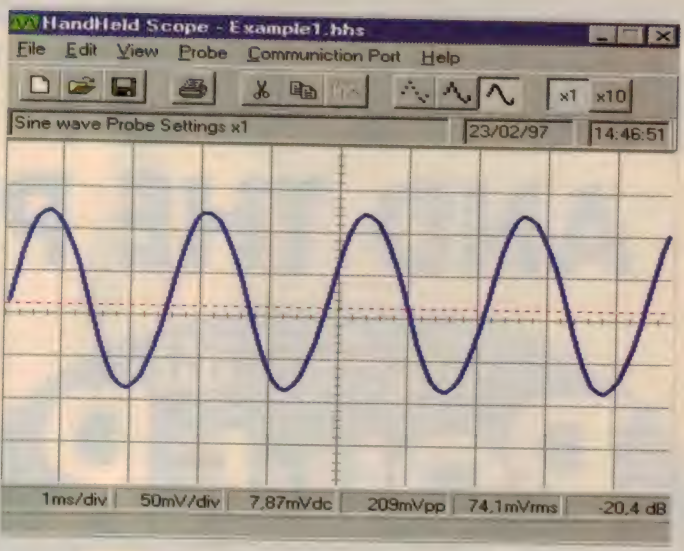
At this point we should point out that using the Handheld Scope in the normal free-standing way is really quite straightforward and intuitive. The operating buttons are well laid out and control the scope's various functions in a logical manner, allowing measurements to be taken quickly and easily. We were particularly impressed with the unit's 'auto-ranging' mode which uses the Auto trigger setting, and rapidly scales both the timebase and vertical range to match the incoming waveform.

The auto-ranging mode works extremely well and is clearly the preferable way to use the HHS5 Handheld Scope during normal measurements. An added bonus of this feature is that it automatically avoids the misleading effects of screen aliasing and multiple sampling that can occur when the timebase is incorrectly set.

Other than that, the Velleman Handheld Scope offers a range of other practical features including a data/waveform hold button, a waveform dot/line function, selectable trigger slopes, a variable-output sinewave generator (400Hz), a fixed squarewave output to aid probe calibration, switchable AC/DC input coupling and an input ground reference button. We found all of these features easy to use, and only needed to refer to the supplied manual to confirm the operation of a couple of the button's secondary functions. The manual is small but nonetheless informative and concise, by the way.

If we were able to pass on a 'wish list' to the Velleman designers though, we would probably include an external trigger input (which would be particularly handy for data logging and PC control), a battery level monitor facility, and finally a *two-way* RS-232 serial link so that the PC could receive sample data on a 'request' basis (this would make any support software very much more effective). On the other hand, as this unit is priced at a fraction of other handheld scopes, perhaps a wish list is somewhat inappropriate...

The Velleman HHS5 Handheld Scope is available from your nearest Jaycar store for $449. As you would expect, Jaycar can also supply the necessary accessories such as a x10 scope probe ($39.50), suitable NiCad batteries ($4.50 each), plus a compatible mains-powered adaptor/charger ($15.50). ❖



Two examples of how 'uploaded' data from the Handheld Scope can be presented on a PC. Above is a screen shot from the windows 95 software available from Velleman's web site (and EA BBS), while the waveform shown on the left was produced using standard comms and spreadsheet software.

Specifications

Max sample rate	5MS/s for repetitive signals 0.5MS/s for single-shot signals
Input impedance	1MΩ/20pF
Max input voltage	100V peak (AC + DC)
Vertical resolution	8-bits (six on LCD display)
Linearity	+/-1 bit
LCD display	64 x 128 pixels
dB measurement	-73dB to +40dB +/-0.5% accuracy
True RMS measurement	0.1mV to 80V 2.5% accuracy
DC measurement	0.1mV to 180V 2% accuracy
Timebase range (/div)	20s to 2us (in 1, 2, 5 format steps)
Input ranges (/div)	5mV to 20V (in 1, 2, 5 format steps)
Sinewave output	approx 1V RMS (adjustable) at 400Hz
Squarewave output	approx 4Vp-p at 400Hz

Velleman HHS5 Handheld Scope

Good points: Low cost and easy to use.
Bad points: Limited bandwidth, display resolution.
RRP: $449 (batteries and probe not included).
Available: Jaycar stores around Australia.

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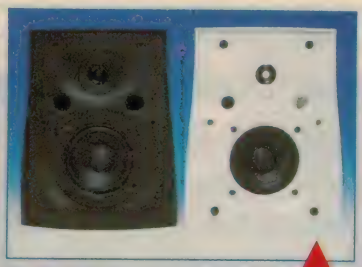

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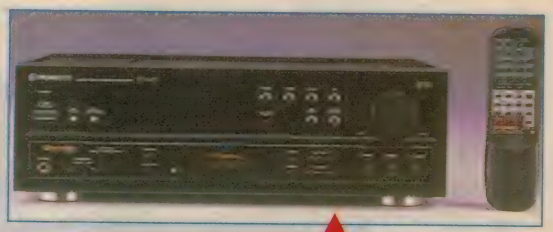

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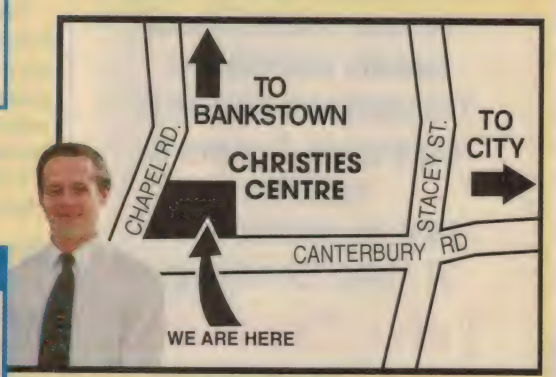

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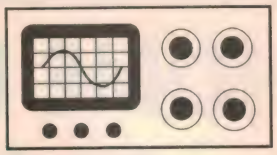

Amplifiers arriving in cardboard boxes, and the longest repair job in history!

Most of this month's column is devoted to a collection of interesting servicing stories from a reader who began his career at the tender age of five — and is now rather despondent about the future of our industry. I'm sure you'll find his reminiscences as fascinating as I did. There's also a story from my own bench, about a fault in 'high-end' video gear that turned out to be far more familiar than I feared...

For the past year or so, I have been involved with a committee that is charged with planning a new training curriculum for electronics technicians. One of the problems frequently mentioned is the complete lack of any fault-finding instruction.

Students learn all about the various building blocks and sub-assemblies that go to make up electronic equipment, and after four years they would certainly know how any piece of gear worked. But never once in their courses do they get to handle a complete radio set, let alone a television receiver!

In future, the well-trained technician will know all about tuning circuits, local oscillators, IF amplifiers, audio amplifiers and power supplies. The student will have to put all of these together by himself if he is going to recognise a simple radio set. It does not bode well for the future supply of trained servicemen.

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READER INFO NO.10

All of this came to mind while I was reading through this month's first story. It's a contribution from Mark van der Eynden, of Mount Waverley in Victoria. Mark's contribution is virtually his life story in servicing, and in many ways it parallels the story of many other servicemen. Most of us began as hobbyists and graduated to full time servicing.

Mark's career began at the early age of — but I'll let him tell his own story....

I have a few servicing stories that your readers may find interesting. They spread over quite a few years, so a bit of background is required to understand the circumstances surrounding them. I call them collectively 'The best of the worst'.

I have been involved with electronics for most of my life. It began on my fifth birthday when I received a 'Philips Electronics Kit'. By the age of six I had learned to solder and was being paid to solder plugs onto earphone leads. They didn't come already attached in those days.

My father was the manager of an electrical goods shop which had a service department upstairs. So from about the time I was eight I spent my school holidays in that service department, doing odd jobs and learning what I could until I was able to do simple repairs all by myself.

Worst home job?

One of the servicemen on the staff at that time undertook a job which I call 'The worst home job ever'.

It involved an AM Radio/Cassette which had chewed up a tape and gagged on it. This was a very common occurrence with the early C120 tapes and/or el cheapo cassettes. The tape would wind around the capstan until there was a large wad jammed there...

Due to the tightness of the jam, the tape could not be removed. The usual trick was to take the back off the unit and turn the flywheel backwards until the tape became loose enough for it to be removed. Some frequent complications were with units where the front came off rather than the back, and others with fixing screws located in the cassette chamber, underneath the jammed cassette.

This unit was of the 'front comes off type' with the more unusual aspect being that the three knobs (volume, tone and band switch) were on that panel and had to be detached before it could be removed. Each of the knobs was recessed into a small aluminium extrusion which made them hard to get at.

The home fixit man had managed to get the screws undone, but had baulked at the knobs. His solution was to run a can opener through the aluminium extrusion! As you can imagine, the knobs were a press fit and Mr Fixit's lack of this knowledge had him pay about one third of the retail cost of the unit for a new case, just to remove a jammed cassette...

On another day a fellow came into the shop to pick up his repair. He had been in twice before, but it was never ready. This was due to the manufacturer not delivering replacement parts on the promised dates, a situation that I'm sure still exists.

What made this day more notable was that the fellow lost his temper and KO'd my father, a man whom I have never seen use physical violence on anything. The service department had never been a profit making venture; it was there to provide employment for four people and a service for the customers of the shop.

Thus, this episode caused the owners

to sell the service department, its staff and stock to another company around the corner whose sole business was servicing electronic equipment. After that, all customers requiring service to their equipment were referred to the business around the corner.

I was still employed, however, and amongst the things I got to do were repairs for 'Privileged Customers'. That's modern marketing speak for what we then called 'regular customers'. It meant that I got to look at various brands of equipment that were still under warranty.

The reason for this was that some companies, whilst marketing an excellent product which usually worked well, had no idea how to fix it if it broke down. This led to two distinct categories of problems. If it went away for repairs, it wouldn't come back for at least three months. Or if it did return promptly, it would still be broken when it was unpacked. Thus, I was able to have first look at the product and could repair many simple faults without having to send it away.

Tackling an intermittent

During this period FM radio appeared on the scene, but specialised service parts were still rather scarce. Down in the shop they had this new whiz bang AM/FM/SW radio cassette which had just been sold to a customer and was about to become my 'Worst Intermittent'.

The customer duly brought it back under warranty. It was returned to the manufacturer — who subsequently sent it back unfixed, with a credit note for a replacement set! My father asked me to look at the faulty unit, figuring that even if it took me a week to fix, there would still a profit to be made in its eventual sale.

Turning the unit on revealed that it almost worked, but the sound was just terrible; a bit like an intermittent speaker. Clearly it couldn't be that easy, if the manufacturer had replaced it with a new set. I removed the back and found a circuit board of about one square foot — remember this was before ICs and surface mount.

A quick check of the speaker revealed it to be perfect. A bit of prodding around revealed that the trouble WAS an intermittent, but it was triggered by the sound coming from the speaker! And what an intermittent it was. If you turned the volume right down, it was sometimes possible to have normal sound. If you so much as touched the case the sound would drop in and out like nobody's business...

I determined that the problem was in the output stage by patching the preamp into another amplifier. This gave no sign of the intermittent. Also suggesting the problem was in the output stage was the fact that someone had spent a lot of time resoldering the entire output stage — not once, but several times.

Well, I couldn't think of anything better to do but to resolder everything again, in the hope of making it better or worse. Either way might enable me to locate the exact cause. Of course it wasn't to be that easy. At this point I put it aside to brew on the back burner.

A few days later, I decided to try resoldering the board whilst it was in a flexed position. I reasoned that the joint should then be either made or unmade, or at least be different to its state in the flat. Resoldering whilst 'flexing in' made no difference so I then tried resoldering whilst 'flexing out'. It was there I hit pay dirt.

I now had a unit that did not work most of the time, but could be thumped into action. It was the work of a minute to trace this to a particular transistor which, when removed, revealed one leg significantly shorter than the other two. Soldering this back in fixed the problem once and for all.

A box of amplifier

One day a customer arrived in the shop with a box containing an amplifier. He didn't mention the box or its contents at first; he just wanted to see and hear a new amplifier. When he had decided on his new purchase he asked my father rather sheepishly if we took trade-ins. My father said yes, and the customer put the box on the counter and opened it up.

Inside was a recent model amplifier. It was complete as far as one could see, except that every screw and nut that could be undone had been. It was to become 'the (almost) best home job'.

My father gave the fellow $10 trade in for the amplifier, for which he seemed grateful — although we couldn't get him to explain how the amplifier had got to be in this condition.

My first action was to put the nuts and bolts back in their correct places. This made the whole package a lot sturdier and also gave me a good idea of what was missing. Believe it or not, nothing had been lost and a cursory glance at the output stage revealed only the bias resistors had been replaced.

Mr Customer had apparently blown the output stage and decided to fix it himself. He noticed the cooked resistors and replaced them. Whether he also replaced the output transistors I couldn't tell. He must have then begun to re-assemble the amplifier and I suspect all went well until it came the time to bolt the output transistors onto the heatsink.

He obviously understood the importance of those funny little washers between the transistors and the heatsink, but he must have misplaced them during the disassembly. So he improvised — cutting out nice neat squares of gaffer tape! Needless to say, a new set of output transistors (this time with mica washers) had the amp

working as good as new.

Longest job ever?

My next story began just after I began working full time. I had spent a year at university studying electronics. However, due to the 'politics' and other problems at the institution I became disenchanted with the course, at the same time becoming more interested in computers.

I started work as a computer operator, but when people became aware that I could repair things electrical, a steady flow of jobs found their way to me to be fixed. Fairly early on a certain amplifier arrived on my bench and this was to become my 'Longest job'.

The complaint sounded simple enough; it would work for about half an hour and then cut out. This amplifier was a four-channel one having DC coupling as a feature. I immediately suspected the output protection circuit was triggering, either because it was faulty or because of a fault elsewhere.

The owner was able to supply a circuit diagram, which showed that the protection circuit worked by mixing the outputs of each amp and then measuring the resultant voltage — disconnecting the speakers via a relay when the voltage exceeded a certain limit.

Checking this voltage revealed that it was drifting higher over time until it tripped the protection circuit. The cause of this drift was traced to one particular channel. The amplifier used one of those clever (cheap?) designs whereby almost every transistor was the same type, and checking the channel in question revealed one of these transistors was leaky.

Since there was another channel that was also drifting slightly, I checked it to find two more leaky transistors. I headed off round to the distributor and requested three replacement transistors but to my amazement, the chap behind the counter nodded, walked away, came back a few seconds later and GAVE me a handful of them!

I didn't count that handful, but I remember that it still wasn't quite enough to replace all the transistors of that type in all four channels. I checked all the transistors in the amplifier and replaced all of those that seemed to be the slightly leaky. I returned the amp to its owner explaining what had happened and asked him to bring it back if it gave trouble again.

Well, every couple of years the trouble did recur, whereupon it would be bought back and I'd replace some more leaky transistors. Very early in the piece I became suspicious that I was replacing transistors I had already replaced once before. But then, since they had all been out for testing, they each had the tell-tale signs of a soldering iron on the circuit board, so I wasn't sure.

Originally I couldn't find any data for the transistors; they were all of a particular early Japanese type. Later on (years on), I found an equivalent listed as well as data so I checked the specs and although a bit close to the wind voltage wise, these limits weren't being exceeded. By this time I had begun using the equivalent type as my handful of originals was now exhausted. But the end was still not in sight.

Eventually the equivalents started becoming leaky and I was also losing my patience. I picked up my trusty data sheets and set about finding a replacement transistor with a bit more voltage headroom. I selected a BC639 (or was it a 640? it's a while ago now...) and refurbished one channel in its entirety.

I ran this channel into a dummy load, (electric stove elements wired to produce about eight ohms) and checked the output produced by a signal generator on the scope. The signal was neat and clean, in fact slightly cleaner than the original transistors. What's more important, it remained clean and stable for several days of intensive soak testing.

I replaced the transistors in the other channels and returned the amp to its owner, for what has proved to be the last time.

It had taken about 14 years from the first time I had seen the amplifier until the final repair and when I last checked it was still working perfectly. I wonder how many of these amps went to the tip after only two years of use?

Is the end nigh?

Well, that's the end of my 'best of the worst' stories and I don't expect to have any more. Why? Because I believe our 'disposable' society has reached the stage where almost nothing is worth repairing.

Example 1: I am often asked about VCRs with bad picture quality. "Is it the heads?" the owner asks. "I doubt it" I reply, "they're probably just dirty, bring it in and I'll have a look for you".

Months go by and I still haven't seen the promised VCR so I ask — only to be told that they bought a new one. "Since it only cost $400 and had heaps of features the old one didn't have".

Example 2: Several times I have been asked about computers that exhibit strange disk errors when turned on. I offer to check it out, explaining that probably all that is wrong is that the BIOS battery has gone flat and thus the system doesn't know what kind of disk is installed.

Checking with the owner a few weeks later revealed that he had purchased a new computer — because "Since the battery was dead, it is only a matter of time before the whole thing packs it in. Anyway I picked up a Pentium with 16 megs of RAM and a two gig drive, for less than I paid for the old one!"

How can you compete?

I don't know, Mark. I don't think you can! And yet, there are still enough people around who are prepared to pay someone to fix their TV, VCR or whatever. The service industry is declining, but it's not dead yet. (Fortunately so. This column would probably die with it, if the service industry collapsed!)

Now back to Mark's other stories. We can all empathise with you about the tin-opener merchant. I think every one of us has come across a customer like that — including the character who, noting the angle on the head drum in his VCR, tried to straighten it up with a pair of slip-joint pliers!

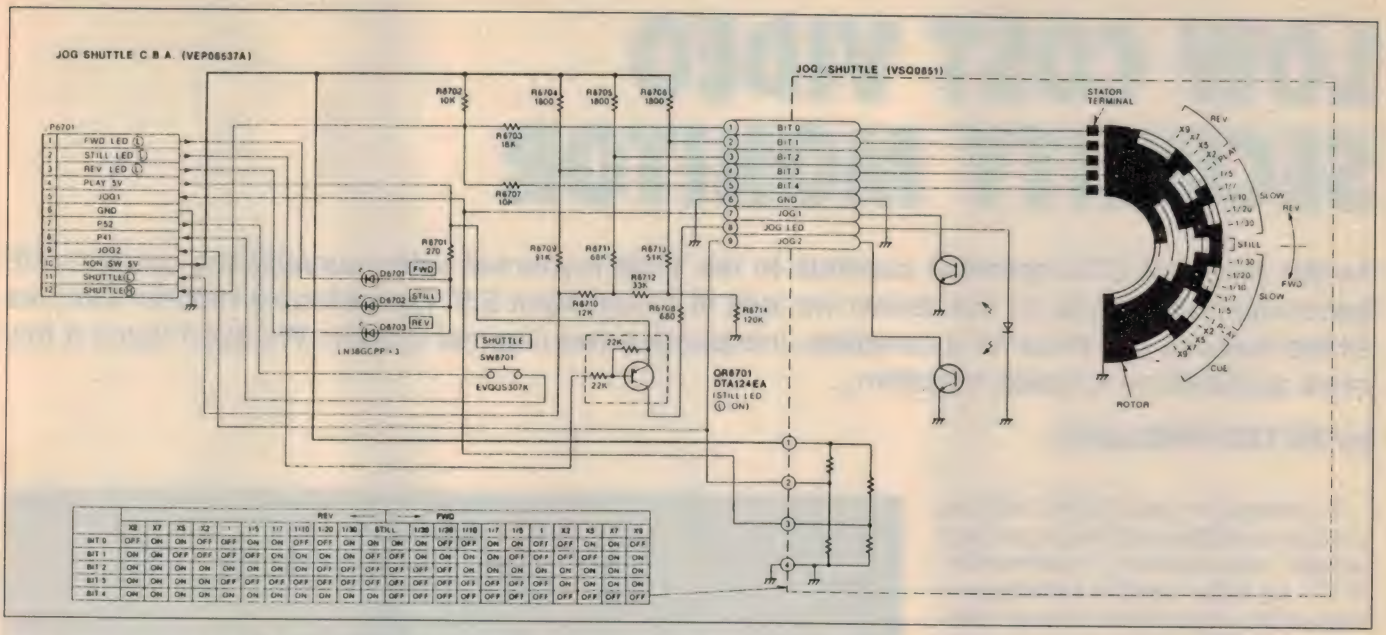
Most of Mark's tales are pretty much routine, except for the 14-year search for a reliable transistor. That one must go down as the longest hunt for a fault in electronics history! As you say Mark, we can only wonder how many of that particular brand and model of amplifier went on the tip, simply because no other serviceman was as patient and persistent as you.

Thanks for those stories, Mark. And I am sorry that you feel there is no future for you in the service industry. You sound like a resourceful technician who could make a living anywhere. Still, you know best and we wish you well in whatever you do in the future.

High-end anxiety

To finish up this month, I'll give you a tale of woe from my own bailiwick.

In fact, the tale is quite disappointing. When it began I thought I would have a long and intriguing story for you, but it's turned into a fizzer. Yet if the actual repair is nothing of any note, the facts surrounding it might be of interest to you.



Part of the circuit for a Panasonic NV-FS90 VCR, showing the 'jog shuttle' control board section. It was this section which was misbehaving in one of the Serviceman's own machines, and the cause of the problem was a familiar one...

My hobby is video production, and for editing I bought three of the best VCRs I could find. They are Panasonic NV-FS90 machines, Super-VHS types with all the bells and whistles (as the saying goes) and almost everything I need for editing and copying my tapes.

The main feature, from my point of view, is the 'Jog and Shuttle' facility. This gives me frame-by-frame control for accurate editing. And when this facility started acting up, I was thrown into a real tizz.

In detail, every time I pressed the Jog/Shuttle button, the machine would go straight into a 'frame advance' mode instead of the pause mode it was supposed to adopt. In this state neither the jog nor shuttle would work; although if I kept the button pressed, the jog and shuttle dials would respond normally. The normal pause button worked OK, except that I couldn't frame advance to the required edit point.

Oddly, the remote control carries duplicate jog and shuttle controls and these worked perfectly. So, whatever the fault was, it was associated with the front panel jog and shuttle board.

Since I have three of these machines, I felt it was wise to buy a service manual — although the first time I needed it, I found it not very helpful. The circuit diagram gives reasonable detail for the shuttle part of the system, but almost nothing about the jog facility. If the trouble lay in that part of the works, then I was going to be pretty much on my own!

My first action was to ask around among my friends, to see if any of them knew anything about jog and shuttle mechanisms and this machine in particular. As soon as I mentioned the model I was interested in, the response was almost universally "Oh! The FS90 is real 'top end' stuff — I've never touched anything like that".

I even asked another friend who *does* touch 'top end stuff', and occasionally some professional stuff, yet even he had never heard of a jog and shuttle failing in just the way mine did. He did make one useful suggestion, though: if I could swap the jog and shuttle board with one of my other machines, and if the fault was swapped too, then a replacement board might be the easiest way to solve the problem.

So I bit the bullet and dismantled the front of the machine. Everything was fairly conventional until I removed the front panel. The jog and shuttle board came away with the panel and revealed a rather unusual plug and socket arrangement.

I would have anticipated a 'socket on a flylead' type of connection, but instead the 12 plug pins projected from the top of a rigid white plastic pillar approximately 20mm long, standing up on the end of the Timer Board. A 12-pin socket overhung the edge of the jog and shuttle board, hopefully in direct alignment with the plug on the Timer Board.

There was absolutely no flexibility in the connection. Even normal thermal flexing must have strained the pins and/or socket. I've never seen a similar connection in any of the VCRs I've repaired in the past, and I would not have expected it in a very expensive S-VHS machine.

The jog and shuttle components were mounted inside a diecast metal housing on the jog/shuttle board and there seemed no way it could be accessed for cleaning or adjustment. So I contented myself with checking the board for dry joints or other obvious faults.

At this point it began to occur to me that the fault just might be due to a faulty plug and socket connection. Have you ever heard of that one before!?

And so it turned out to be. I sprayed the pins and the socket with contact cleaner, gave them a quick tickle with a stiff brush, then reassembled the front panel and tested the machine. It was perfect!

So all of my worries about difficult faults in 'top end' equipment counted for nothing. You would think that after all my years in the service industry, I would have learned not to worry until I had proved the fault to be really difficult. In this case I was worrying myself into an ulcer, all for no reason at all.

They say "you can't teach an old dog new tricks". I'm beginning to think you can't teach an old dog ANY tricks!

I still don't know how the jog facility works. I suspect that it is associated with the photodiode and two phototransistors shown here in the circuit diagram. There is probably a segmented wheel between the diode and transistors, similar to the arrangement of wheels and diodes in a computer mouse. But since the whole assembly is inaccessible inside its diecast box, I don't suppose it matters much.

Well, that's it for this month. I'll see what I can put together for next time. 'Bye for now. ❖

LOW COST VIDEO SECURITY MONITOR

As the prices of CCD cameras continue to fall, build-it-yourself video surveillance systems are becoming more viable. In this review we look at a dual-input 5.5" monochrome monitor that has all the features you need for a complete, inexpensive two channel system. We even found a few more applications for such a system...

by PETER PHILLIPS

A problem for most people building a video surveillance system is getting a suitable video monitor. A conventional TV set either needs a modulator to convert the video output from the camera to an RF signal, or you need to modify the set to accept direct video. As well, this arrangement can usually only work with one camera, and rarely has an audio channel.

This neat little monitor from Oatley Electronics is made in China and was originally sold as part of a complete surveillance system. It came with a CCD camera (with inbuilt microphone), mounting bracket for the camera, extension speaker and AC adaptor. We don't know how much this system cost, but Oatley Electronics is now offering the monitor itself, without the peripherals, for $125. A six-pin mini DIN connector is also included.

A typical price for a suitable CCD camera is around $120, so by the time you add a DC power supply, a speaker and other attachments, you can have a complete single channel surveillance system for less than $300. Many readers will probably already have everything except a CCD camera, making the system even cheaper at around $250.

The monitor in question, with a small camera module perched on the top. It may not win any styling awards, but it's flexible and attractively priced.

The monitor

Perhaps the most impressive feature of this monitor is its ability to accept *two* video/audio channels. Either channel can be selected from front panel pushbuttons, or, when set to AUTO mode, the monitor automatically switches between the two. The switching rate is adjustable at the front panel and is variable from one to 30 seconds.

Each 'channel' connects via a six-pin mini DIN connector on the rear of the monitor. Both connectors have lines for the video output of the camera, an external speaker, 12V DC (output) and a line level audio input to the monitor. The 12V DC output can power the camera and a microphone preamp.

This means you can have a setup like that shown in the block diagram, with each 'system' linked to the monitor via a six-core cable. We don't know the current capability of the monitor's output DC supply, but it's likely it can also drive an IR light source. Oatley Electronics has a kit for a simple IR light source ($18) which takes around 30mA. A more powerful IR light source might need to be connected directly to the external power supply.

The monitor comes with an inbuilt microphone and speaker, with a 'press to talk' pushbutton on the front panel. To get two-way conversation, you need to add a microphone and preamp, both installed near the camera. A kit to do this is available from Oatley Electronics ($8). Also on the front panel are the power on-off switch, a volume control for the audio and three pushbuttons that select the AUTO

switching function or either of the two input channels. Four LED indicators show power on and the selected input mode (Ch1, Ch2 or AUTO).

The monitor has video and audio output RCA connectors on the back panel for connection to a VCR. Also on the back panel are the DC input socket and adjustments for contrast, brightness and vertical hold.

Resolution of the monitor is given as 500 lines, which exceeds that of a typical CCD camera (380 lines). It measures 158 x 152 x 195mm (WHD) and is housed in a cream plastic case with a moulded recess as a carry handle. It weighs around 1.5kg.

The monitor operates from a nominal 13.8V DC power supply, and a complete single channel system takes close to one amp. Adding a second channel increases the current consumption, so a 2A supply is ideal.

Test results

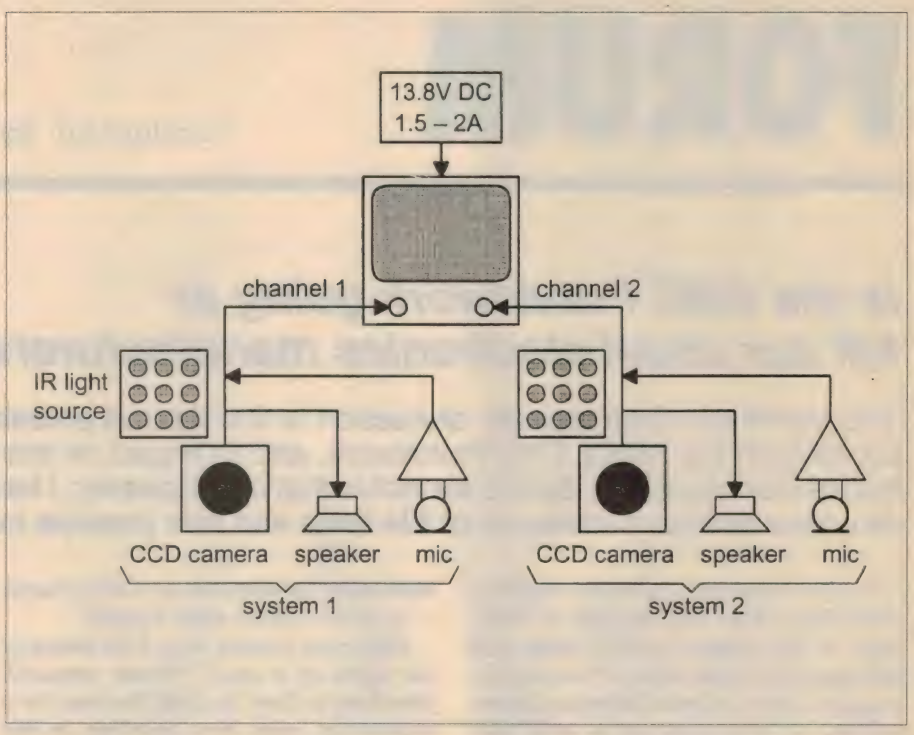
For the purposes of this review, Oatley Electronics also provided a CCD camera and a 10 metre six-core lead with a DIN connector, along with the monitor. The lead has one shielded conductor (for the video signal) and four other conductors, giving the necessary connections for camera power, a speaker mounted near the camera, and a line level audio input back to the monitor.

This lead is not supplied with the monitor, but as already mentioned, a mini DIN connector is supplied so you can make your own lead. Information on the plug connections is included with the monitor.

We tested the system with a 12V 2A switch-mode power supply available from Oatley Electronics ($17). This supply is very compact and comes from a computer terminal case. The supply provided by Oatley Electronics for this review had an output voltage of 11.4V, but is easily adjusted to the specified 13.8V. The supply voltage is not critical, and the system works well with a supply voltage as low as 11.4V, with the contrast and picture quality improving marginally as this voltage is increased. This is probably due to the performance of the camera improving with an increased voltage, rather than that of the monitor itself.

Getting the system going took only a few minutes, and we were quite impressed with the results. For example, when the camera lens was adjusted and pointed at a page of eight-point type, we could easily read the text from the monitor.

We found the audio output level of the speaker at the camera was quite low, but more than enough for the purpose. You need to be within 100mm or so of the inbuilt microphone to get an adequate sound level at the external speaker. We didn't set up a two-way audio channel, but found that an audio signal level of 200mV p-p back to the monitor gave a suitable sound level from the monitor's speaker.



Using the switching built into the monitor, you can easily switch between two different camera-speaker-microphone combinations. The monitor also operates from 13.8V DC, making battery operation quite feasible.

Other uses

While the monitor is intended for a surveillance system, we experimented with a few other applications. One that could appeal to those with ageing vision (like this reviewer) is to use the camera/monitor system as an aid to reading component values and part numbers in poor light conditions. Just hold the camera near the component and read the information from the screen. Writing that is otherwise illegible appears on the screen almost like magic!

As well, you can also often get a tiny CCD camera into places your head can't go, so inaccessible components can be identified without the usual contortions.

Another use is to inspect soldered joints. The camera supplied for this review has an adjustable lens, so in a dedicated inspection system, you can set the lens to give considerable magnification to show up those soldering faults. Holding an eyeglass or magnifying loupe in front of the camera lens gives even more magnification.

Professional inspection systems usually have a colour CCD camera, external lighting and a suitable lens. These cost thousands of dollars, but for less than $300 you get something similar with this simple system.

Because the whole system can run off a 12V lead-acid battery, you could also use it to inspect places that are otherwise inaccessible, such as ceiling cavities, pipe work and so on. For these and other similar applications you can put the camera in a glass jar to protect it. The glass jar can also be made watertight for inspecting the underside of a boat.

In summary, we believe this monitor is excellent value. It is small and light, making it useful for portable applications. It also works with the video output signal from a VCR or similar, making it useful as a workshop monitor. But when combined with a CCD camera, it has lots of applications, including video surveillance. Remember too, that a typical CCD camera works in infrared light, so you could set it up to monitor a baby or a patient, without needing external light other than an IR light source.

The review monitor was supplied by Oatley Electronics and has an RRP of $125. For more information, contact Oatley Electronics, PO Box 89, Oatley 2223, phone (02) 9584 3563, email oatley@world.net. ❖

FORUM

Conducted by Jim Rowe

Is the EMC Framework going to kill our small electronics manufacturers?

This month our main topic for discussion is one that we probably should have looked at earlier, but haven't: the SMA's EMC Framework, and its impact on the viability of Australia's small electronics manufacturers. Before we tackle that one, however, I have a couple of follow-up responses on our various discussions of EM fields and their possible health risks.

As I've noted here in recent columns, there hasn't been any shortage of feedback on the subject of EM fields and their possible health risks. It's obviously a subject that is of great interest to many readers, but I'm trying not to let it 'take over' Forum to the detriment of everything else.

This month, I'll present a couple of recent responses that I think you'll find of interest, and then pass on to a different subject — one that is really of great relevance and concern, even though we haven't given it much space as yet.

To begin, then, here's one of the two responses we'll look at to keep the EM fields and health topic simmering along. It comes from Mr Peter Ryan, of Wanganui in New Zealand, who is actually responding to the story in the May column from Bill Jackson, concerning the 'Pest Free' electronic pest deterrent device:

With reference to your article on the radiation from the 'Pest Free' in your Forum of EA May 97 issue, it was a breath of fresh air to hear that Australians believe in low frequency low level EMR — even if concerned about the side effects.

You will probably be surprised to learn that we don't have the problem here in New Zealand, as these low level pulses don't exist over here. A number of so-called state employed NZ experts last year appeared on a local TV program (Ch1, 16 May 1996) called 'Fair Go' (not famous for being accurate in its presentation) and rubbished the whole concept, claiming that no electromagnetic waves were being radiated. They included the opinions of Mr Bruce Rapley, representing the Production Technology department of our local Massey University and a Mr Martin Gledall representing the National Radiation laboratories in Christchurch — a bit of a worry these experts!

On a more serious note, I am aware of the work of a small private research firm here in New Zealand that has for a number of years been working in this field and are using the assistance of some of the world's leading experts to confirm their findings. As a result they are discovering some most incredible benefits from using specialised low level, low frequency EMR in many applications.

It is interesting to note that most comment on EMR is negative. It is also very interesting to note that any good results from this field will effect the profitability of two of the wealthiest and powerful industries in the world, the chemical and medical industries — both of which are bugged with side effect problems with a number of their products.

I feel one must take a fairly neutral position when looking at complaints, because it appears a discrediting program is well under way, as more and more research is starting to take place throughout the world in this field. No reflection on your original complainant — the unit he complains about is very basic for this sort ofapplication. I can assure you there is far more sophisticated equipment being used to understand and research this field.

I am convinced that the future includes the use of low level, low frequency EMR, cost effective and healthy products which are not far away and less chemicals and drugs.

I hope I have been able to show another side of the issue and thank you for Forum; it is an excellent and much needed platform for issues. Like many others I look forward to it each month. Keep up the good work, you are doing a great job.

Thank you for those comments, Mr Ryan, and for the kind words at the end. It's interesting that some positive potential uses are emerging for low-level low frequency radiation; can we take it that at least some New Zealanders believe that such radiation can have an effect on living cells, at levels below that which results in measurable heating? Many of *our* experts don't seem to believe in any such interaction, of either the beneficial or detrimental type...

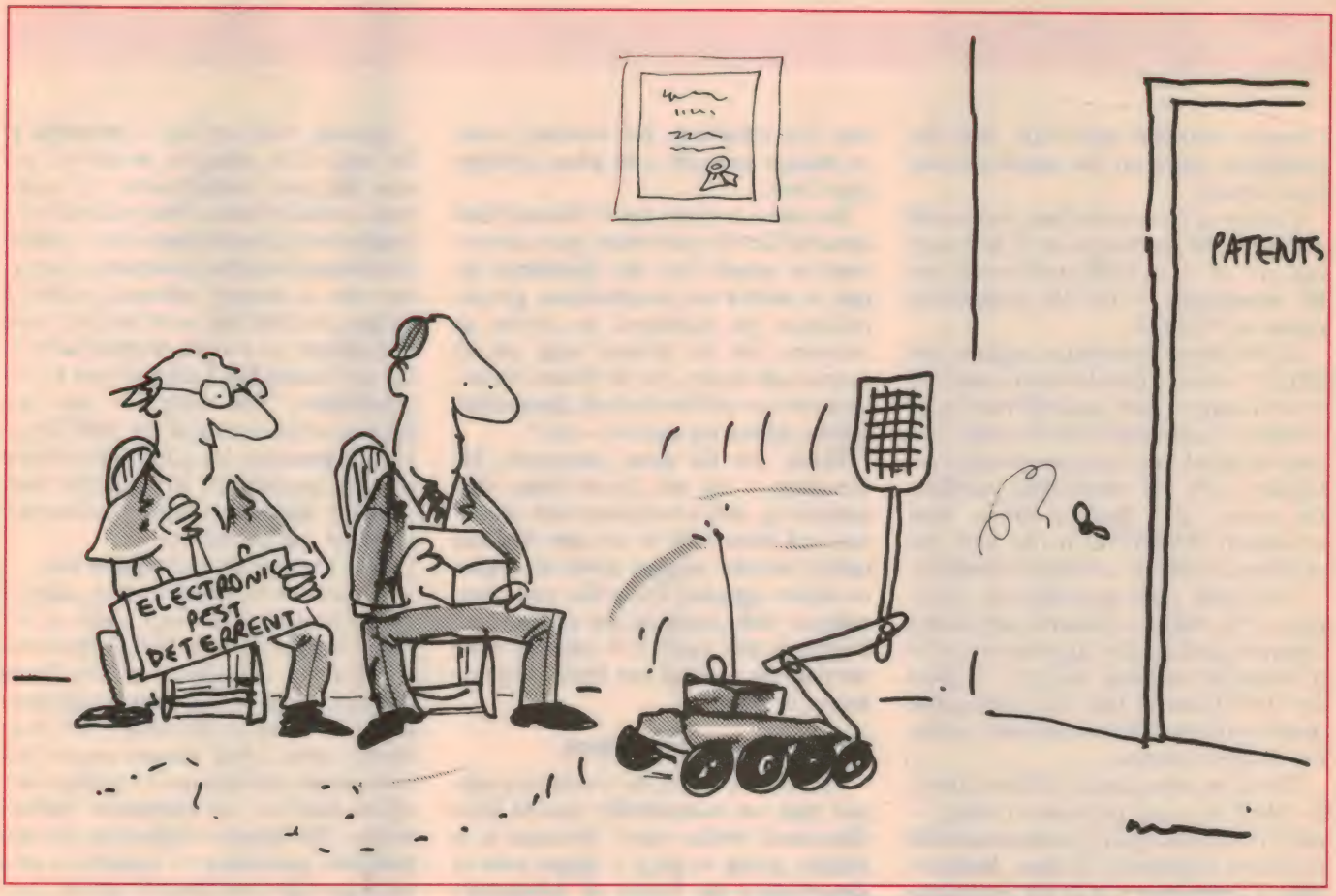
'We do not know...'

Moving on, our second response comes from Mr Michael Gempton, who sent it via the EA Reader Services BBS. Mr Gempton doesn't seem to be responding to any particular aspect of the debate, but makes a number of interesting general comments — in particular, about the attitudes necessary for objective scientific research:

I am absolutely amazed at the extremes of opinion so vehemently expressed and with such authority, augmented by the use of findings from some specific research efforts being applied WAY outside their scope. (And I DO mean SPECIFIC — just take a look at some of their titles and/or constraining parameters.)

However, it is comforting to see some discernment beginning to be applied to the discussion, with the subject of thermal effects being appropriately partitioned and awareness of the vested interests of some powerful players in the debate tempering the impact of THEIR categorical conclusions.

At this point in time — as far as I am aware — any conclusive statements on the 'Non-thermal Biological Effects of Electromagnetic Radiation' are based on an absolute lack of definitive proof on this electric subject; with one excep-



tion (isn't there always?!) and that is, quite simply: 'We do not know'.

Whilst many people run scared at the mere thought of such an admission, it is the first essential step towards learning. Those who have taken this step automatically support the search for knowledge, through roles which range from the neutral interested party who allows investigation, to the dedicated research pioneer who champions it. Those who cannot make this admission, will only hinder progress.

Extreme views 'vital'

This is not to say that I would want to censor any opinion, at either end of the spectrum. Far from it! I personally feel that even extremist views serve a number of vital purposes.

Firstly, they give air to the little bit of a radical in us all. This allows us to take comfort in the fact that our extremist issues are being dealt with (especially with no risk to ourselves) — so we can focus on more productive pursuits.

Secondly, it is good for extreme opinion (at both ends) to be openly presented, especially when their (often) absurdity is clearly seen. Such beacons help identify the boundaries and provide reference points to those employed in honest endeavours, lest they should drift into darkness and be unfairly dismissed as quacks.

Lastly, it is often good for wild ideas to be expressed as these often lead to innovation in thought — brainstorming and lateral thinking, if you will — and since we have yet to attain satisfactory understanding on the subject at hand, regular stirring of the grey matter seems to be in order!

It is this last point that highlights the greatest difficulty and the greatest potential in supplying answers.

For starters, do we really know what AGENCY we should be investigating?

"Excuse me?" you say, "Isn't that $%@!? obvious?!"*

My response is that yes, it may well be, but we have to make sure we have asked the right QUESTION — otherwise we might not be working in the right direction.

If I were asking the question I would like answered, it would be along the lines of: "What adverse effects are the result of occupying an environment which is subjected to electromagnetic radiation?" My reasoning is simple: I don't care WHAT the mechanism is, but if it can make me sick, I WANT TO KNOW!

The obvious starting point is on the direct effects of EMR on the human body — which is where I see all the breast-beating going on at the moment — so I'll quickly throw in my two cents' worth as well...

Since the human body is electrically conductive, then any alternating magnetic component of an electromagnetic field will induce currents in it. So this is an effect... But more questions need to be addressed: How does the human body respond to this? Does it cause damage? What sort of damage does it cause? Is the damage permanent or repairable? And so on. (I expect the molecular biologists, molecular physicists and molecular chemists could, and probably are, having a ball with these and a thousand other questions.)

Indirect effects?

Then there are the indirect effects. Let me illustrate by offering the following (totally unfounded) hypotheses:

1. "That cancer is caused by chemical poisoning resulting from ingestion of a product of a reaction between acid rain and the insulation material on above-ground power lines."

2. "That cancer is caused as the result of an infection from the inhalation of bacteria which feed on a product of a

reaction between acid rain and the insulation material on above-ground power lines."

If either of these were true, you would still have the problem even if all power was cut off — so EMR itself would not be responsible — but the companion elements WOULD.

As the above hypotheses suggest, the TRUE cause of a problem may consist of several stages, each possibly having an obscure relationship with the other and none of which may have an obvious correlation with the observable problem. Or worse, that factors which have absolutely NOTHING to do with the problem are falsely ascribed culpability.

This latter point is where the discipline of investigation must be absolutely objective and totally rigorous in order to maintain complete integrity. If there are ANY flaws in this, the conclusions drawn will be compromised and probably rendered useless.

Therefore, anecdotal evidence cannot, in itself, be used to prove a thing — unless additional facts can be assembled to give it legitimacy. It does, however, offer a supportive role in the evaluation of theories and is an invaluable source of directions to pursue.

I understand the 'Scientific Method' as BEING that discipline — one that involves a great deal of meticulous attention to detail and ordered processes with appropriate controls. You know, the kind of background YOU would want to see when adopting someone else's findings, but wouldn't want to burden yourself with when offering your own...

So where to from here? Onward and upward! Let the extremists give voice to keep us awake. Let the hypotheses be put, to stretch our imaginations. Let the evidence be examined to arrive at answers. Let the debates rage on, to keep us all honest. Let the forum continue so we can all be involved. Remember, no-one knows the answer — yet!

Thank you for those comments, Mr Gempton. I for one found them very interesting, and a welcome waft of reason and objectivity in an area that can easily become bogged down in dogma or hidden agendas. I also like your open attitude with regard to the airing of all views on this subject; I couldn't have defined the goals of our Forum column better, in fact.

The EMC Framework

Moving on again, let's turn to a subject that we undoubtedly should have discussed before now, because it is clearly going to play a major role in determining the future of Australia's electronics manufacturing industry. It's the Spectrum Management Authority's EMC Framework, a body of legislation which became law on January 1 this year.

I imagine that probably no-one would wish to argue with the SMA's motives in bringing in this legislation, which are entirely laudable: to try and ensure that the electrical and electronic equipment sold in Australia meets acknowledged standards for electromagnetic compatibility — i.e., low levels of electromagnetic emission, and also low susceptibility to incoming radiation). However, the problem seems to be that by imposing yet another set of bureaucratic hurdles and constraints, the EMC Framework is imposing a crippling burden on our local electronics manufacturers. Not so much on the large national and multinational manufacturers, who can in most cases amortise the additional costs and overheads quite easily, but in particular on the smaller manufacturers who can't.

In fact quite a few people in the industry have suggested that in their opinion, the EMC Framework is effectively going to kill most of our smaller electronics manufacturers, and merely consolidate the dominant position of overseas-owned multinationals. Not a cheerful prospect at all...

Anyway, that's by way of preamble to the letter I'm going to present to you now for your consideration. It comes from a reader who *is* the principal of a smaller local manufacturer, and is therefore written from the viewpoint of someone who is directly affected. Although he has provided me with his full name and address, as a token of good faith, he has also asked that I refer to him by the pseudonym 'Jim Fixit' — not just because of the nature of the EMC legislation's penalties, but also because of the risk that anything he writes might inadvertently implicate industry colleagues, suppliers and importers.

Here's what 'Mr Fixit' has to say:

I have been waiting for you to address in the magazine at least some of the issues raised by the EMC legislation which came into force on the 1st of January this year. You may recall that I spoke with you in December last year, shortly after I had become aware that low volume manufacturers such as ourselves had lost our exemption without notice. The situation regarding kits and therefore publishing of projects is also most unclear and directly affects your magazine (and others of course). We can't afford to bury our heads in the sand; this issue is not going to go away!

I have enclosed some clippings from the UK magazine 'Electronics World'. The editorial from the October 1996 issue is almost 100% relevant in an Australian context and I urge that you read it. There is also some other editorial from the same issue, regarding Australian EMC legislation, and a couple of letters. It is intriguing that there have been mentions of Australian EMC issues in another country's technical press, when it seems that the issues are being ignored here.

This year, in the normal course of my business, I have made a point of querying many of my industry colleagues about their knowledge of EMC, and I have to say that most of them are either completely unaware of their obligations or are just ignoring them! This is the stuff that ulcers are made of.

Mr Howard's Government claims to be reducing the amount of red tape and administrative costs for small business, but it seems that the electronics industry has not only been excluded from this promise, but indeed penalised.

I started my company in 1988. Since then I have designed hundreds of items of equipment and about 50 of those are

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still made on a continuing basis, albeit in small quantities in most cases. I serve a niche market and if I felt that I had to justify my existence, then I would say that the continued support from our customers in the form of purchase orders is justification enough.

Before the reader says "So what?", let me point out that a big seller for me still only sells less than 100 per annum, and that only one or two of my models would reach that dizzying height.

A quick, though revealing survey of several of the EMC testing facilities indicates that testing of a single piece of equipment takes at least one day, maybe longer depending upon its complexity. The cost of this testing ranges roughly from $1500 to $3000 per day. If an item fails a test, it has to be re-submitted. Simple mathematics suggests to me that simply to be allowed to keep manufacturing my current range, assuming that an item passes first time, and assuming averages of $2000 per day to test, 1.5 days for each item, and 50 items, I'm up for around $150,000. And that's NOT a worst-case scenario!

I, and I'm quite sure, many hundreds or even thousands of Australian micro-businesses (I find the term 'small business' inappropriate) like mine cannot afford this kind of cost, which equates to six years' wages for one employee (or one year's wages for six employees).

So, basically we now have a law which gives us an ultimatum: Pay an enormous amount of money by 1999, or close the doors!

Small firms not invited

At this point I could express my opinion of the people that framed this legislation, but there are other laws which prevent me from doing so. In any case, I and my industry colleagues never received an invitation to submit any suggestions when the legislation was being framed, so perhaps I could be forgiven for believing that our interests have not been considered nor represented. Additionally, the legislation assumes that a designer/manufacturer is guilty until proven innocent — hardly democratic.

Now to some more specific stuff. Anyone can design and make a single protoype without any EMC testing or technical construction file being required. More than one and the intervention of a third party, the 'competent body', is mandatory — at great expense of both money and time.

Anything that is 'not generally available' may also bypass the need for a 'competent body' to prove its compliance. At what point does something become generally available? When it is offered for sale, when it is advertised, when the design is published, when? Too vague for me!

Home-made radio amateur apparatus is also exempt. I recall that you debated the need for radio amateur projects some time ago, and that the general outcome was that not many hams make their own gear any more. This is borne out by the distinct lack of 'ham' projects in the magazine, or any magazine for that matter.

I think it safe to assume, and I think that you have established, that amateur and professional electronics enthusiasts make up the majority of your readership and that these days, radio amateurs are mainly short-wave communicators AND electronics enthusiasts — buying, not building their communications equipment. Yet they are specifically exempted.

And what about computer enthusiasts? There are more and more projects for computers — data loggers, digitisers, virtual CRO's, virtual multimeters, BIOS testers, all sorts of I/O boards, the list goes on and on. The vast bulk of your readership is NOT exempted from EMC testing! Maybe the legislators see us all as radio amateurs? That's just ignorant and politically incorrect. I demand to be recognised as an electronics enthusiast!

Having raised the subject of computers, I have to mention a rather nasty aspect of the EMC legislation. When an item of equipment is presented for testing, it's exact construction down to the most minute detail is what is being tested. Any change — that's ANY change — necessitates re-testing!

The businesses assembling generic PC's are not exempt from EMC testing, yet I haven't seen a single generic PC with the C-tick logo or the CE logo. This would most likely be because they would have to pay enormous amounts to have all their various configurations tested. The case styles and motherboards and graphics cards and internal modems and sound cards, etc., etc., etc., change almost monthly too, and every little change requires re-testing of all configurations. This will make PC's unaffordable — the industry will collapse, the EMC testers will get rich in the meantime. Erhh, that is if anybody actually obeys the letter of the EMC law...

The big PC companies (you know who they are) only offer a few configurations and seem to have opted for testing in other countries. Some bear the European 'CE' logo which is apparently acceptable to the Spectrum Management Authority (soon to be

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merged into Austel). But say you buy a big-name PC and decide that a faster modem or graphics card, etc. is required. As soon as you put that card in, that PC no longer complies and has to be re-tested. This is plainly ridiculous and unenforceable.

One of the letters from the Electronics World clippings I have included raises the question of the validity of overseas EMC testing. In my possession I have a piece of digital equipment intended for video manipulation. It bears the CE logo, but causes severe interference to Channel 10 for about a 50-metre radius, and lesser but still annoying interference to the other channels and FM radio.

I thought the intention of the EMC legislation was to prevent just this sort of interference. Every little gadget that comes from Asia now bears the CE logo. Do they actually comply, or does testing there consist of sticking on the CE label?

Not so long ago you discussed the use of mobile phones and laptop computers in airplanes. Surely the CE or C-tick logo on these items guarantees their compliance? Surely the high-tech equipment on airplanes complies too — so what's the problem, what's the big picture here?

I think it is curious that Australia has embraced the European EMC standards, when we seem to be so much more at one with America. Their FCC regulations seem so much more workable. Warnings regarding radiated interference and received interference adorn American equipment, the solution to any problems being placed where it belongs — the user.

Let's face it, you can't protect people from themselves. People will always use things for purposes and in situations that they were not designed for. Even the strict Australian EMC laws won't stop this.

I think it is reasonable to ensure that any equipment we make does not radiate RFI. I don't think it is reasonable to have to spend large amounts of money testing small-volume, low cost manufacturing, where the cost of testing will have a major effect on the selling price. Perhaps the legislation could be altered to exempt from EMC any production run where the cost of compliance exceeds a small percentage of the manufacturing cost.

Understanding the jargon

How do we 'micro-businesses' test our equipment in-house? What test equipment do we need? What levels are acceptable? What frequencies do we have to measure between? Some of the answers are available in the relevant standards documents, that is if you can understand all the jargonised mumbo-jumbo.

I think this is where EA has a responsibility to the readership. How about some practical articles on in-house EMC testing — you know, rules of thumb, perhaps some constructional articles for test equipment which will at least give us a chance to find problems before we have to spend small fortunes with 'competent bodies'?

How about showing us how responsible you and your contributing designers are, by publishing your in-house EMC test results with each project?

I'd like to design some projects for publication, but I am concerned, as should any of your current contributors be, that a great axe is likely to fall. The penalties for ignoring EMC are very harsh and I don't see where kits are exempted. Perhaps you can clear the air and prove that electronics enthusiasts' kits are definitely exempt. Maybe by publishing this letter, you can influence the politicians to make some changes to the EMC legislation to make life a bit easier for us all.

I suppose I have been raving on. I realise that you may not publish all of this missive due to its length, or perhaps for other reasons, but the Australian EMC issue has been ignored and I am very concerned about my company's continued viability, with the massive costs of both money and time that must be found before 1999. New products are also out of the question for my company, so we are slowly strangulating.

Hmmm, there's quite a lot of food for thought there, isn't there? My sincere thanks to 'Mr Fixit' for sharing his concerns with us. It certainly sounds as if the EMC Framework is likely to cause severe problems for firms like Mr Fixit's, and could easily cause the demise of many of them before the end of the century/millenium. That doesn't augur well for the future of Australia's electronics industry, does it?

By the way, like other electronics magazine editors, I imagine, I approached the SMA last year and asked for clarification regarding the possible impact of the EMC Framework on our publication of project designs, and the ability of firms to sell kits for them. The answer seemed to be that because we effectively only sell information, we're not covered by the legislation — at least for the present. Similarly since kit firms only sell a collection of components rather than a product, they too are not affected as yet...

As Mr Fixit points out, though, small manufacturing companies are very much affected. It looks as if you'll be allowed to pursue electronics design and assembly as a hobbyist, without any hurdles. But if you want to start your own manufacturing business, be warned: it's now a lot harder and more expensive than it was. ❖

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As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS), which makes available a wide range of useful information for convenient access and rapid downloading.

The BBS is ANSI compatible and is currently operational for virtually 24 hours a day, seven days a week, on (02) 9353 0627. Use any speed to 28.8kb/s.

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ESTABLISHED SINCE 1977

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Record your own CDs-for IBM compatible PC

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PUBLISH YOUR OWN CDS
2X SPEED WRITE & 6X SPEED READ.

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$799

Recording Speed:
2x - 300 Kbytes/sec (sustained)

Playback Speed:
6x - 900 Kbytes/sec (sustained)
10 MB/sec (burst asynchronous) Average Access Time:220ms

- Make your own CDs for music, audio, data archiving and backup, digital imaging, creation of multimedia titles and corporate training videos.
- Hold up to 650MB of music, data, or video on one CD, which can be played in any standard CD-ROM drive
- Free software included for Windows 3.1, Windows 95, Windows NT, and Microsoft
- Perfect for entertainment, home office, small office, corporate, government and educational use
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Contents:
- Easy-CD Pro Suite
- Packet recording software
- Macromedia Backstage Designer Plus
- Tray Loader
- 1 Verbatim CD-R Blank disk
- User Manuals
- Host Adaptor
- Smart and Friendly CD Labeling System
- Verbatim Mouse Pad

HOT NEW D-I-Y AUTO ITEMS!

FLUSH-MOUNT SPEAKERS FOR CAR STEREO

16.5cm 3-way.

ALL NEW!

- Input 200 W max. Music Power
- Connecting wires included

C12048 $29.95

INSTALL THEM YOURSELF FOR GREAT SOUND.

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C12050 $69.95

6" x 9" Polypropylene Four Way Speakers- Japanese Dynamic Labs

- Max 500W + 500W=1000W *Maximum Musuc Power*
- 163 x 237mm woofer- 1/2kg Strontium magnet
- Midrange 63mm -70g Strontium magnet
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- Super Tweeter -25mm
- Japanese voice coil
- Impedance 4 ohms
- Sensitivity 93 dB/W (1m)
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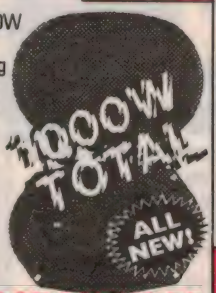

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HIGH POWER DIGITAL SPEAKER SYSTEM

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Super 180Watts Maximum Music Power

C12049 $49.95

- 165mm three way
- 180 watts max
- 60 watts RMS
- 10oz High-flux density ferrite mount
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- Tweeter: 0.5" piezo
- Freq resp: 45-22,000Hz
- Impedance: 4 ohm

Install them yourself FOR A SUPA BLAST!

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A16065 $39.95

- Auto Stop/ Fast Foward cassette player
- AM/FM 2 channel manual tuning radio
- Radio & Tape LED indicator
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- Easy to install

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3.5" DISKETTE STORAGE BOX

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- Holds up to 100 3.5" diskettes
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- Space saving design
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BONUS ITEMS INCLUDED:
- 3.5" cleaning kit
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IOMEGA CARRY BAG

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X17068	SCSI Controller Adaptor AHA-1520B	$179
X18165	16bit ETHERNET RJ45 + BNC	$49
X15810	Ethernet 5-port 10 base T hub	$149
X15814	Ethernet HUB 10 base T Connector (8 RJ45 Effective)	$179
X15816	Ethernet HUB 16 base T Connector (14 RJ45 Effective)	$349
X15818	Ethernet HUB 20 base T Connector (19 RJ45 Effective)	$369
X18228	Printer Lpt123 Card 16-Bit *NEW!*	$49
X18232	Printer 2-Port Slot Lpt123 Card 16-Bit *NEW!*	$69
X18017	Printer Slot Lpt 1 Card	$19.95
X18141	High Speed Serial Card 1-Port 16550	$49.95
X18041	High Speed Serial Card 2-Port 16550AFN	$59.95
X18143	High Speed Serial Card 4-Port 16550AFN	$189
C14260	SMART GAMES Cont	$39.95
X18171	Ethernet **Intel PnP** BNC/RJ45 16-bit	$169
	*Ethernet **III Rev B Coax (BNC, AUI)**	$199
X17396	OEM SBlaster PnP Vibra 16 with IDE interface	$109
X17394	OEM SBlaster PnP Vibra 16 without IDE interface	$89
X17398	OEM SBlaster PnP Vibra 32 Sound Card	$179
X17357	OEM PhoneBlaster	$289
X17250	ESS 16 Bit Sound Card	$39

SB OEM products do not have manual or connection cables

**AVAILABLE TO ORDER*

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X18210	2MB WRAM GrafixStar 700 Video	$499
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29 Msec Average seek time

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Comes complete with Windows/DOS installation disk and one zip disk with zip tools software!

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E&OE 8/97

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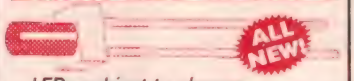
AD590J CURRENT OUTPUT TEMPERATURE TRANSDUCER
U20720 ..... **$12.95**

To suit Temperature Adaptor (Electronics Today International)

2MM LED LAMPS



LEDs subject to change

Cat No.	COLOUR	WAVE LENGTH	LUMINOUS INSTENSITY mcd
Z10185	RED	700	0.5-12.5
Z10186	GREEN	565	3.2-8.0
Z10187	YELLOW	590	3.2-8.0
Z10188	ORANGE	625	12.5-32.0

FOR "TRAFFIC LIGHTS FOR AN INTERSECTION" KIT No. K10835

1 ..... 30¢
10+ ..... 25¢
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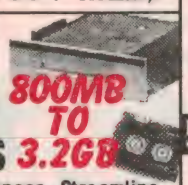

Protect Your Business. Streamline Your Office. • Safeguard Your Business. Protect Your Data Against Accidental Deletion, Theft, Fire, Floods...By Performing Regular Tape Backups

Contents: • Backup EXEC software, cables and manuals included for all these models*

CAT No. CAPACITY ..... PRICE

***Internal Floppy Tape Drive**
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X20430 800MB INTERNAL $345

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with 1 Travan TR-3 tape, Controller Card and Mounting Hardware
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with 1 Travan TR-1 tape
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TOWER ATX CASE & P.S. $199
200WATT AT P.S. only $49.95

ALL NEW ELECTRONIC KITS

NO PICTURE AT TIME OF PUBLICATION!

THE MINISTROBE: USING THE WHITE LED

This little project take advantage of the White LED's bright white light, its high efficiency and fast response time. The Ministrobe can effectively "stop the motion" of almost anything running from 400 to 4000rpm, such as electric motors, car engines, electric mixer.

EA Aug '97

K10870 **$24.45**

AUDIO FREQUENCY SHIFTER

Here's a new low cost design for a unit which can be of great assistance in controlling feedback ("howl-round") in public address and other sound reinforcement systems. It operates by shifting the audio spectrum by 5Hz, and features a very low noise and distortion over a full 20Hz to 20kHz bandwidth. ***EA Aug '97***

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This little project is just the shot for those occasions where a low-voltage regulated DC source is needed from a small package. Based on a robust but low-cost regulator IC, the adaptor uses push-on jumper links to preset the output voltage between 3V and 15V, and depending on the heatsink you use, can deliver an output current of up to 1.5 amps. You can use it to power external peripherals from a PC, or to run a personal CD player from a car's cigarette lighter socket.

EA Aug'97

K10860 **$8.45**

Addressable Card for Driving One Stepper Motor

This interface card allows you to drive a stepper motor using software control. It plugs into your PC's parallel port and you can connect up to eight units in daisy-chain fashion.

SC Aug'97

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Kill pain with TRANSCUTANEOUS ELECTRICAL STIMULATION

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PER BOX OF 10 FLOPPY DISKS

TO BE PHASED OUT SOON- YOUR LAST CHANCE TO STOCK UP!

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$3.50	**$3.00**	**$2.50**

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PER BOX OF 10 DISKETTES

REAL CHEAP DISKS- DON'T PAY MORE THAN YOU NEED TO!

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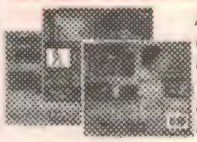
SPECIAL DEALS!!

DON'T FORGET TO DROP INTO OUR MELBOURNE CITY AND NORTHCOTE STORES. WE HAVE FROM TIME TO TIME OLD/ FAULTY MONITORS, DISK DRIVES, HARD DISK AND OTHER ITEMS AT CHEAP PRICES

Trial Ware Games



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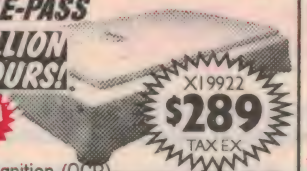
1 BILLION COLOURS!



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X19922 **$289** TAX EX **$349** TAX INC

- A4, 30-bit, 1 Billion colours, 600dpi, 4800 dpi interpolated
- Enhanced Parallel port with printer port pass-through for printer connection
- Software includes for Optical Character Recognition (OCR)- OmniPage LE OCR or TypeReader, PhotoMagic-Image editing

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Connect 4 VGA monitors to 1 computer. Great for seminars, presentations, and schools.

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Connect 8 VGA monitors to 1 computer. Simultaneous display.

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For networking installation using BNC 50 ohm coax cabling that are preassembled ready-to-use cables with BNC connectors at both end.

BNC 50 ohm Network Cables:

Cat No.	Length	Price
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P37701	1m	$6.95
P37702	2m	$6.95
P37703	3m *Male-Male*	$7.95
P37705	5m *Male-Male*	$8.95
P37710	10m *Male-Male*	$9.95
P37715	15m *Male-Male*	$15.95
P37720	20m *Male-Male*	$17.95
P37730	30m *Male-Male*	$29.95
P37740	40m *Male-Male*	$39.95
P37750	50m *Male-Male*	$49.95

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PLUS 50 hours FREE Internet Access - (Conditions Apply)

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- Dynamic & fast tracking
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- Ultra-sensitive fire button
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THE AFFORDABLE PERSONAL STORAGE SOLUTION

- 100MB Zip disks hold all your stuff • Are inexpensive, reliable and ready to help you get organized
- Use as many disks as you need

Av Seek Time: 29msec

Available for IBM and Mac

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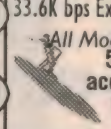

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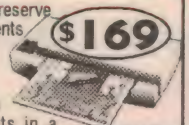
you can protect and preserve your favourite documents - **up to A4 size,** business cards, recipes, membership cards, and other types of paper thin objects in a waterproof, airtight seal.



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A91118 216 x 303mm (A4) **$89.00** PKT100
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All on display at all Stores

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PRODUCE YOUR OWN CDs!

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Everything you'll ever need to get things done at home on your Personal Computer!

Have more fun at home with... Microsoft- • Word • Works 4.0 • Encarta 97 World Atlas • Greeting Workshop • Internet Explorer • Arcarde • Fonts • Clip art and more!

RITRON COMPUTER SYSTEMS

CPU TYPE	512K Cache M.B.	TAX EX	TAX INC
6x86-133/166P		$940	$1145
6x86-200P		$970	$1165
Pentium™ 133		$1015	$1235
Pentium™ 150		$1040	$1268
Pentium™ 166		$1160	$1415
Pentium™ 200		$1280	$1520
Pentium™ 166MMX		$1275	$1555
Pentium™ 200MMX		$1590	$1895
With 512K Cache Motherboard-			
Pentium™ Pro 180		$1690	$2065
Pentium™ Pro 200		$1810	$2208
Pentium™ II 233		$2020	$2465
Pentium™ II 266		$2225	$2715

•8 MEG RAM •1.3 GIG H.D.D.-*GREAT VALUE!* •1.44 MEG 3.5 FDD •Mini or Baby AT casing •2 SPG Ports •104 Keyboard •14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor • Systems now fitted with PCI video cards - Better performance value for the same price. •*Pentium Pro system comes with 16MB of RAM and AT style case & P.S. ATX case & P.S. available as optional extra.*

FREE 3 HOUR TRAINING COURSE (MELB. ONLY) FOR ALL COMPUTER SYSTEMS INCLUDING MULTIMEDIA SYSTEMS

4 YEAR SYSTEM WARRANTY
Manufacturer's Warranty apply for Monitor
3 Months Consumables Warranty

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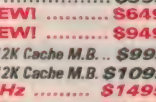

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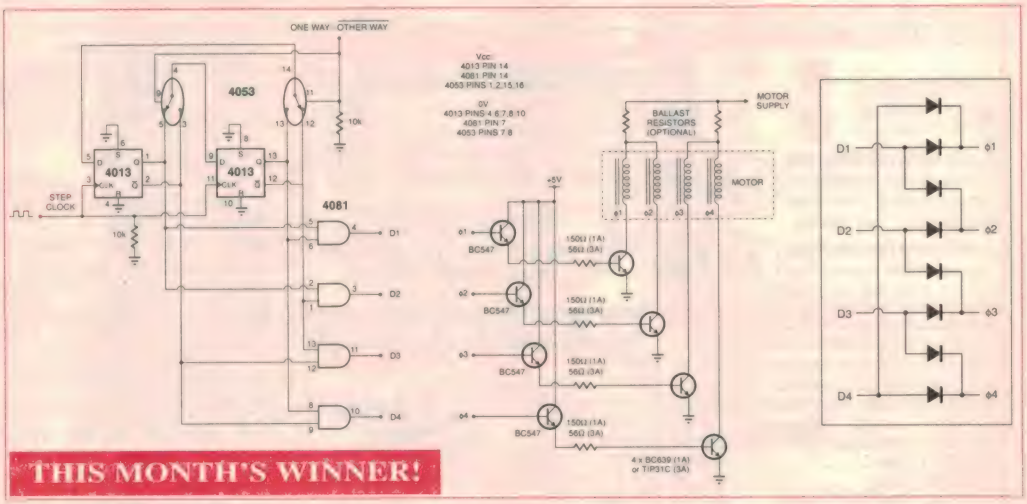
Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Unipolar stepper motor driver



This circuit lets you control stepper motors without the hassles of computers, custom chips or heaps of Darlington transistors. It is suitable for both six and eight wire motors, with the drive limited by the switching components specified.

The circuit is based on a 4013 wired up as a Johnson counter, where the output of the final stage is inverted and fed back to the data input of the first stage. Most stepper motors contain four windings, and turning them on in the right sequence will cause the motor to run in one direction; reversing the sequence causes the motor to run in the other direction.

We can implement this direction change quite easily in this two flip-flop design, by moving each data input to the complementary output of the other flip-flop. This is achieved by two bilateral switches which switch between the Q and Q-bar outputs of each flip-flop.

The four AND gates decode the outputs of the Johnson counter into four distinct states, and these decoded outputs are connected to the output transistors driving the motor. There is a choice of either 'wave' or 'two-phase' sequencing to drive the motor. During wave driving only one winding is energised at a time, while two-phase turns on two phases at a time, producing more torque. To wave drive, simply connect D1 to ϕ1, D2 to ϕ2, etc. Connecting eight diodes between the 4081 and the driving transistors as shown will run the motor in the two-phase sequence.

My motor only needed 280mA per phase so BC639s were used. Rather than connecting the 547s to the 639s in a Darlington configuration, I wired them as emitter followers. This reduces the Vce to around 500mV as opposed to 1 volt for a Darlington pair. It may not seem much, but when the transistor is in a TO-92 package, anything you do to limit power dissipation helps.

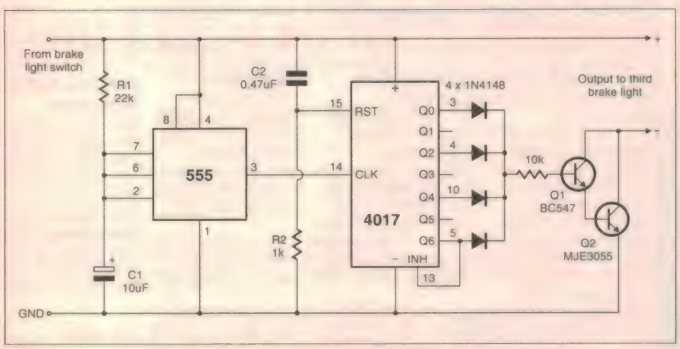
The 150Ω resistors will allow 25mA to flow into the bases of the switching transistors. If you want over 1A per phase, reduce the 150Ω down to 56Ω, and replace the BC639s with TIP31Cs. This should be good for about 1.6A, depending on the hfe of your transistors. Anything over that, ditch the transistors and drive FETs from the logic.

The ballast resistors are chosen to limit the winding current to the rated value, should the supply voltage be higher than the rated voltage of the motor. The advantage of running with ballast resistors is better high speed performance.

Nick Baroni
Greensborough, Vic. **$40**

Eye level brake light flasher

Many modern cars have a strip of bright lights (usually LEDs) mounted at eye level at the rear, connected to the brake lights. These turn on whenever the brakes are applied, giving the driver behind better warning that you are going to stop. Sometimes even this isn't enough, however, and so I came up with this circuit.



The circuit shown here flashes the rear light three times before staying on until the brake pedal is released.

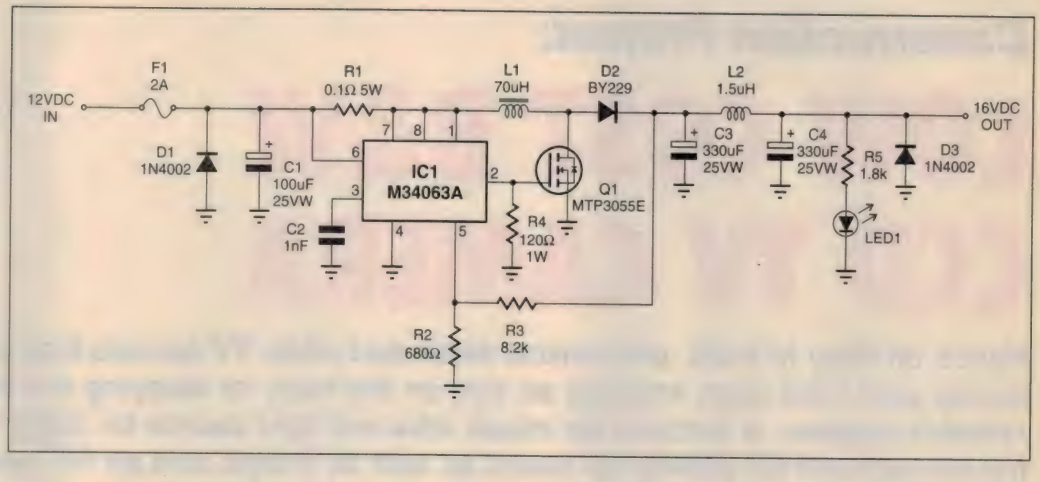
When the brake pedal is applied, the circuit receives power, and the 555 timer IC begins to oscillate at approximately 2Hz. The 4017 decade counter is initially reset by C2 and R2, and is subsequently clocked by the output of the 555.

The 4017 outputs are ORed together via the four diodes, and the output is then fed to Q1 and Q2, wired together as a Darlington pair. The power transistor Q2 then switches the negative supply to the brake light strip. The flashing light effect is attained by ORing the Q0, Q2, Q4 and Q6 outputs of the 4017, with Q1, Q3 and Q5 left unconnected. Once Q6 goes high, the 4017 is inhibited and the brake light remains on continuously.

Installation is a breeze — the third eye-level brake light usually has a connector that will let you simply connect this circuit in series.

'KRL',
Toowoomba, Qld. **$30**

Booster for 12V motors



This circuit, although relatively simple, boosts the speed of small DC motors such as fans or mini drills by about 25%. It does this by using a Motorola MC34063A DC-DC converter IC to step the 12V supply up to 16V DC. This extra voltage will not damage most lightly loaded DC motors such as fans, and most mini drills are rated up to 18V anyway.

In operation, R1 sets the coil current limit, C2 sets the operating frequency (around 30kHz), and R2/R3 determine the output voltage (in this case, about 16.3V).

The PWM output at pin 2 of the IC is applied to the gate of Q1, an MTP 3055E power MOSFET. This in turn switches the input voltage across L1, a 70uH coil, generating the higher voltage. This voltage is then rectified by D2, a BY229 fast acting diode, and then smoothed by C3.

L2 and C4 are optional filter components to remove excessive ripple from the output, allowing the unit to power other electronic equipment with fewer problems.

My prototype has been running without problems for several months and has been tested in excess of 22W for five minutes, and 20W continuously.

Although very little heat is generated by the MOSFET and a mini heat sink will suffice, D2 the BY229 rectifier diode needs a heatsink capable of dissipating several watts due to the large current surges involved.

Coil L1 consists of 27 turns of 1mm enamelled copper wire wound onto a Siemens 25mm E-core (N27 ferrite). Before assembly, 1mm must be filed from one of the centre legs of the core to provide an air gap.

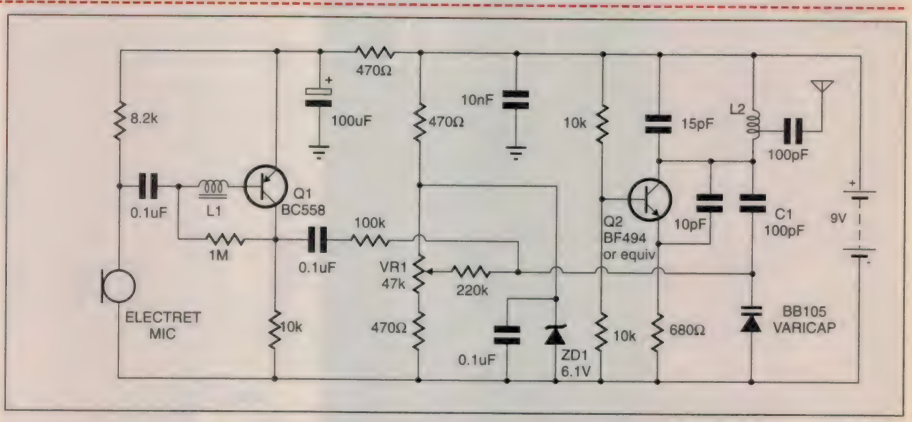
Coil L2 is much simpler: 18 turns of 1mm ECW wound into an 8mm diameter coil. (I used a pen to form this coil.)

D1 is in place to blow the fuse if reverse polarity is applied, but if the extra 0.6V drop is acceptable D1 can be connected in series with F1, preventing conduction in the event of a reversed connection.

If this converter is run from a power supply, it may be necessary to increase the value of C1 to 470uF or 1000uF.

Stephen Carrol
Timmsvale, NSW **$30**

FM transmitter uses varicap tuning



I made an FM transmitter recently, based on the circuit published in *Electronics Australia* December 1996. The main difference is that this circuit uses a varicap diode to tune the transmitter instead of the more touchy variable capacitor.

PNP transistor Q1 is connected in a self biasing configuration, with L1 serving to prevent any stray RF from overloading the input stage (L1 consists of 5 turns of 25 SWG wire wound on a small ferrite bead core). The audio output signal is applied across the varicap diode (a BB105 or similar) via a 100k resistor.

VR1 sets the DC bias on the varicap, and sets the circuit's operating frequency. ZD1 maintains a stable 6V reference on the top of VR1, while C1 blocks the DC through the coil. The circuit is designed to cover the 88 to 108MHz FM band with the values given.

The main tuning coil is wound with four turns of 20swg ECW, space wound on a 4mm air cored former. The aerial tap is made at one turn from the bottom end of the coil. With a quarter-wavelength antenna (70cm) a reasonable range of 150-200 metres can be achieved. The circuit only draws 10mA, and so could be run on a standard PP9 9V battery.

Pradeep G.
Alappuzha, South India **$25**

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As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a compact CCD video camera module from sponsor **Allthings Sales & Services**, offering 460 TV lines of horizontal resolution and 0.05 lux sensitivity, and valued at $199.00!

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Construction Project:

LOW COST B&W CCD TV CAMERA

Here's an easy to build, economical black and white TV camera that is very suitable for monitoring your front door, keeping an eye on the baby or studying the nocturnal habits of your resident possum. It features an inbuilt infra-red light source for night viewing, a built-in electret microphone for picking up sound as well as image, and an RF modulator to allow convenient use of a TV receiver as the monitor.

Although there are low-cost black and white TV cameras on the market, they generally don't include features like an inbuilt RF modulator, microphone or IR (infra-red) light source for night work. The easy to build project to be described here incorporates all of these features, while at the same time costing less than most commercial cameras. It should therefore be of interest to anyone wanting a camera for surveillance or monitoring use.

It's based on one of the miniature black and white CCD camera modules, coupled with an electret microphone and preamp. For flexibility it provides separate composite video and audio outputs, as well as a modulated RF output on television channel 0 or 1. This means that its image output can be either viewed on a video monitor and heard via a monitoring amplifier, or seen and heard on a standard TV receiver.

A bank of seven IR LEDs is also built in, to provide a source of 'invisible' infra-red lighting when the camera is used at night.

A further feature is that the camera is quite compact. With an overall depth of only 50mm it can be set up as a fairly unintrusive monitor or intercom. If desired it could even be combined with an audio/video transmitter to avoid running cables through walls.

The power supply it requires is a nominal 12V DC at 150mA, which could be supplied from a 12V/200mA DC plugpack, or from any other suitably rated battery or DC supply between 11V and 14V.

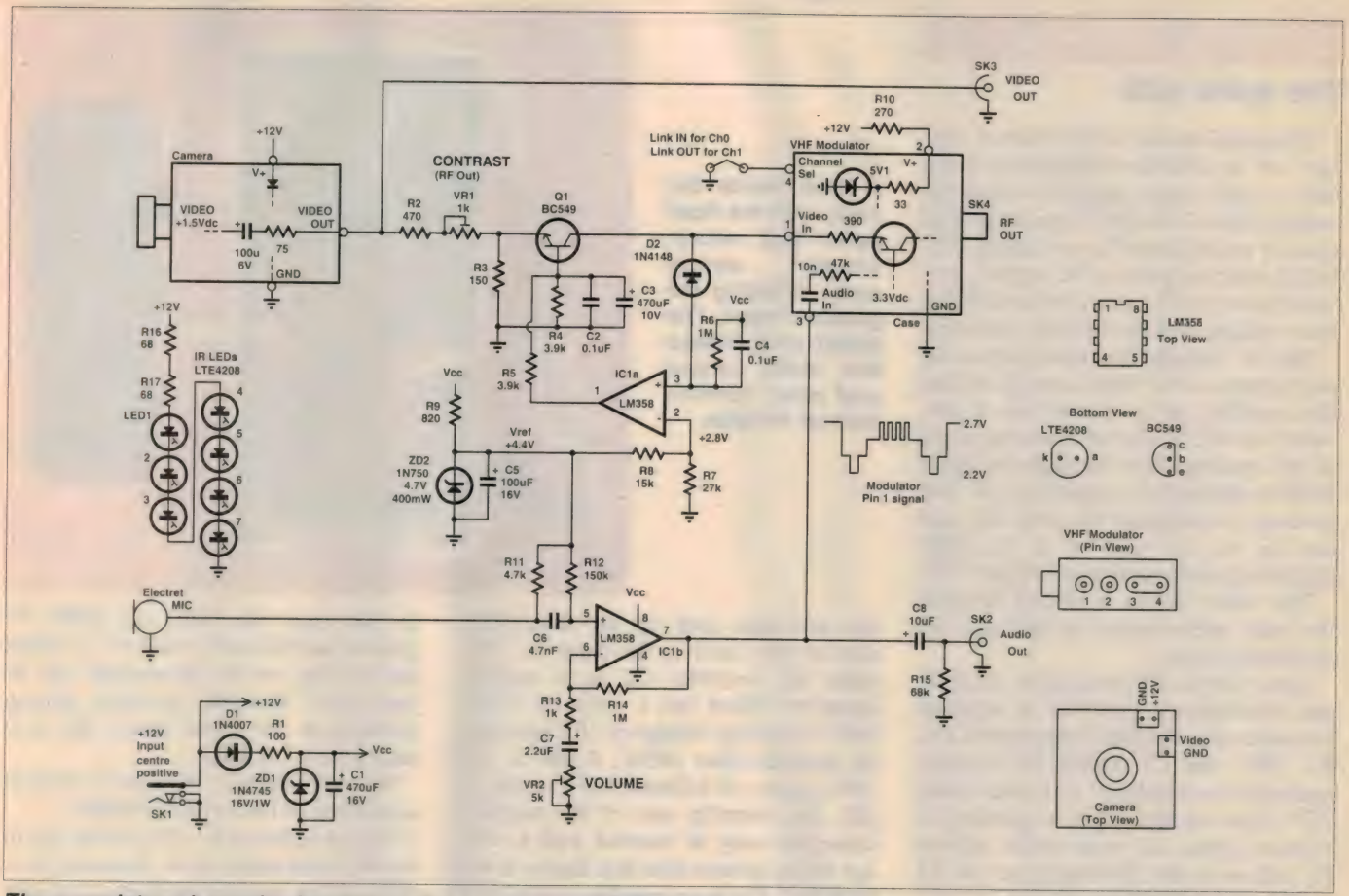
Incidentally the design of this project was carried out by the R&D Department of Dick Smith Electronics, and not surprisingly DSE will be marketing complete kits for the camera. Listed in their catalog as K-5416, the kit is priced at $149.00 and will be available through all Dick Smith Electronics stores and stockists.

Here's the complete camera, only slightly smaller than actual size. Note the infra-red LEDs in the centre, with the mic insert below them.

The camera module

The camera module is made of a 38mm square printed circuit board, with video processing circuitry using exclusively surface mount components. In the centre of the module is a plastic lens assembly with a CCD (charge coupled device) image sensor at its base. Connections to the module include a 12V DC input and a composite video output.

The CCD sensor is a semiconductor chip measuring 6mm x 5mm, containing an array of light sensitive elements. The value of the charges on the array elements vary with the intensity of the inci-



The complete schematic. Apart from the camera and VHF modulator modules, there isn't much else involved. The infra-red LEDs provide a 'hidden' light source when the camera is used at night.

dent light, and so the array captures the image focused onto it in pixel form. The image is scanned by shifting the charges serially through the CCD array, out to the processing circuitry where it is converted to composite video. The specifications for the camera module are shown in Table 1.

The module has its own reverse polarity protection and filtering, and so is connected directly to the camera's main power input rather than through the external protection circuitry.

As with many CCD sensors, the camera module is sensitive in the infra-red as well as in the optical range of the electromagnetic spectrum. To take advantage of this, seven infra-red LEDs have been included to allow night viewing without any visible light — albeit at reduced visibility compared with normal lighting.

The LEDs are connected in series, and emit constantly whether it is day or night. However they could be disconnected or made switchable if you wish, to reduce power consumption. The IR LEDs used have a maximum continuous current rating of 50mA, but in this circuit the current is limited to 27mA at 12V by series resistors R16 and R17. The LEDs have a typical forward voltage drop of 1.2V.

VHF modulator

The main purpose of including a modulator with the camera is to allow a standard television receiver to be used as the camera monitor. Televisions and VCRs that have a separate audio and video input as well as the antenna input do not need the modulator.

The modulator has separate video and audio inputs, and these are used to modulate an RF oscillator and produce a signal very similar to that from a television station. This signal is tuned to VHF channel 0 if the link on pin 4 is inserted (connecting pin 4 to ground), or VHF channel 1 if the link is left out (pin 4 disconnected).

The optimum video level for the modulator is one within the limits of +2.2V and +2.7V. For maximum audio output, an input of 5V peak to peak is required. Power for the modulator is taken from the DC input via resistor R10. The modulator has a built-in zener shunt regulator which protects it from reverse polarity or voltage surges.

The video output from the camera module is shared between the main video output and the video input to the modulator. To ensure a stable picture from the modulator, a DC restoration circuit has been inserted before the video input. If the video signal were capacitively coupled to the modulator then the variations in picture intensity would cause the average video voltage to vary, possibly causing the sync pulses to vary, and ultimately causing picture distortion.

The DC restoration circuit uses Q1 to control the modulator video input current so that the sync pulse tips, which are at the negative peak of the waveform, are clamped at +2.2V. Components D2, R6 and C4 form a negative peak detector, developing a voltage on pin 3 of IC1a equal to the minimum video signal level plus 0.6V (one diode drop).

A 2.8V DC reference is derived from 4.7V zener diode ZD2 and applied to pin 2 of IC1a. If the minimum video level goes above 2.2V, then the output of IC1a increases and turns Q1 on some more, pulling the video voltage down. Conversely, if the minimum video level falls below 2.2V, the bias on Q1 is reduced — allowing the video voltage to rise. The peak-to-peak amplitude of the video signal is adjusted with trimpot VR1 to be 0.5V.

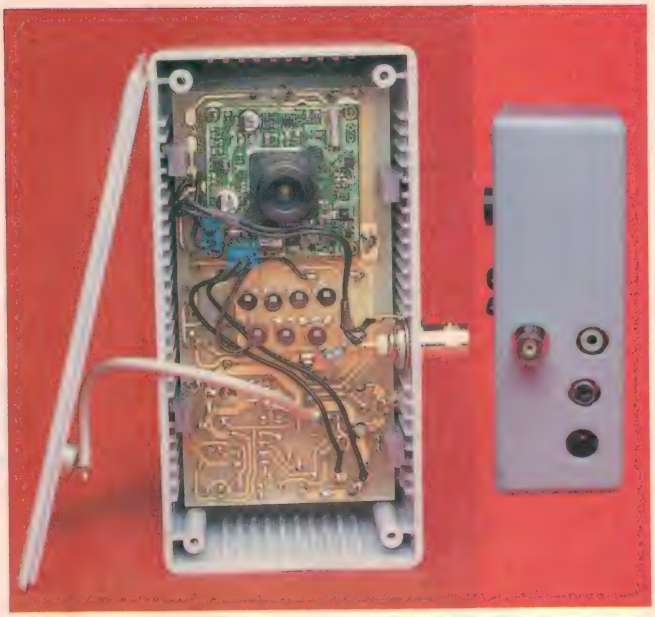
The audio side

The audio section of the camera consists of an electret microphone insert and a single stage amplifier using the second half of the LM358 package. The electret microphone has an inbuilt FET buffer which requires a DC supply, provided here via R11 from the same reference voltage used by the video circuitry.

The DC voltage developed across the microphone is not stable enough to bias the amplifier, so a separate bias is provided via R12 to the non-inverting input of the op-amp. The microphone signal itself is capacitively coupled by C6. The op-amp is configured for unity DC gain and for an AC gain of up to 1000, depending on the setting of trimpot VR2.

The audio output is shared between the main audio output at SK2 and the modulator input.

Power for the DC restoration circuitry and microphone amplifier is supplied via protection and filter components D1, R1, ZD1 and C1. Diode D1 protects against reverse polarity and zener diode ZD1 clips voltage surges. Capacitor C1 reduces ripple and noise while resistor R1 enhances the filtering effect of C1 and limits current through ZD1.



A look inside the case, with the front panel and microphone swung away, showing the general layout. The insert shot shows the video output and other connectors on the side.

Assembly

For the purposes of the description below, the copper track side of the PCB will be called the 'bottom' of the PCB and the other side the 'top'.

To place the components, look at the relevant overlay diagram which shows how the components actually appear on the PCB. Read the label of the component, C2 for example from the top overlay, and then look up the description next to that label in the parts list. The parts list describes C2 as a ceramic capacitor which has a value of 0.1uF, with a working voltage of 50V and may be marked either 100nF, 0.1uF or 104 (104 means 10 followed by 4 zeros, in pF). Occasionally one of the supplied capacitors may be marked with a voltage rating greater than that shown in the parts list. This is acceptable providing it fits on the PCB. If the voltage rating is less than that shown in the parts list then advice should be sought unless the discrepancy is explained in the errata section at the end of the instructions.

In most cases the component lead spacing will match the hole spacing in the PCB and the component will be inserted fully to minimise mechanical vibration, inductance, etc. However sometimes the spacings will not match. In that case, the leads can either be given a double bend ('cranked') to adapt the spacing, or the component can be just partly inserted, avoiding putting pressure at the point where the lead enters the component.

For convenience, the project is best assembled in the sequence below:

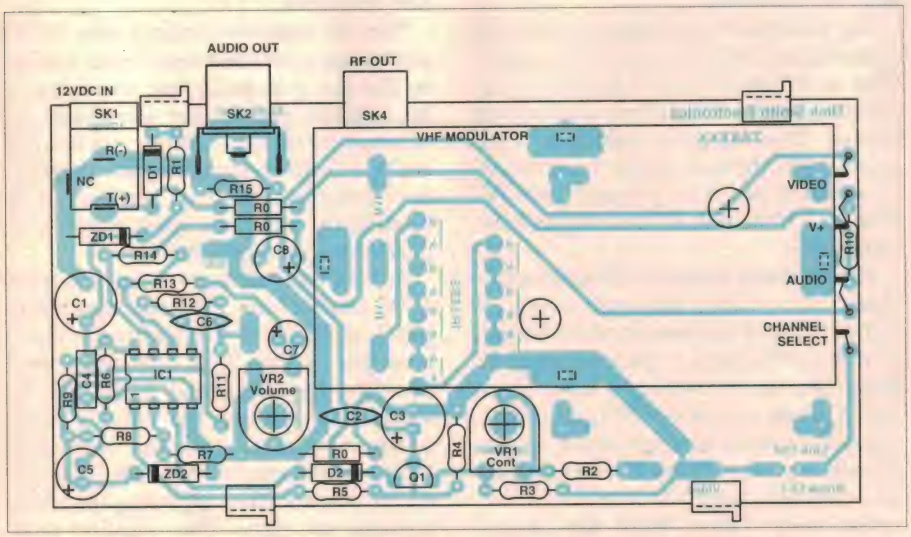
(1) Insert resistors R1-15 into the top of the PCB and solder them. Resistors have their values marked on them as colour coded bands, which are given in the parts list. The last band of the colour code gives the tolerance value and is the colour band furthest from the others. Resistors can be mounted in either direction on the PCB, but it is good practice to mount them with their colour codes all in the same direction so that it is easier to read the values later.

Some of the resistors on the overlay are labeled R0. These are actually wire links, built like resistors and have a single black band in the centre.

(2) Insert diodes D1, D2 and ZD1/2 into the top of the PCB and solder them. Diodes have a band on them at one end (cathode) and must be mounted in the direction shown on the diagram. There may be more than one band, but only one end of the diode should have a band at the very edge.

(3) Insert IC1 into the top of the PCB and solder it. This IC has a case with two parallel rows of four pins, called a dual-in-line package or DIP. There is a dot or notch on the top, at the end near pin 1, and the overlay diagram shows which way around the IC has to be mounted. The pins count anticlockwise from pin 1, looking at the top of the package.

(4) Insert trimpots VR1 and VR2 into the top of the PCB and solder them. These



Use this overlay diagram as a guide when you're fitting the components to the non-copper side of the main PCB.

have their value printed on them in text. There should be a hole in the PCB below each trimpot to allow adjusting tool access from the track side of the board.

(5) Insert transistor Q1 into the top of the PCB and solder it. This must be mounted with the flat face in the direction shown on the overlay diagram.

(6) Remove the two plugs from the camera module and desolder and remove both the DC socket SK1 and the video output socket SK3. Insert the DC socket into the top of the PCB. Bend the lugs over to make it mechanically secure in the PCB before soldering.

(7) Insert the RCA (audio output) socket SK2 into the top of the PCB and bend its leads over to secure it to the PCB before soldering.

(8) Insert capacitors C2, 4 and 6 into the top of the PCB and solder them. These are non-polar types and so can be mounted in either direction.

(9) Insert electrolytic capacitors C1, 3, 5, 7 and 8 into the top of the PCB and solder them. These are polarised types, which means you have to identify which lead is positive and which is negative. Usually the negative lead is marked by a stripe with a negative (-) sign on it.

(10) Trim the mounting lugs on the modulator with a pair of side cutters and insert it into the top of the PCB. Bend the lugs down as flat as possible and solder them. Insert and solder the four leads at the end of the modulator.

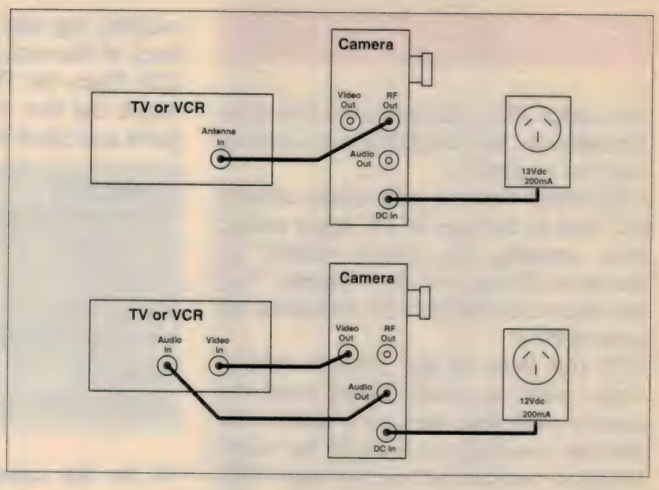
(11) Solder resistors R16 and R17 to the *bottom* surface of the PCB, on the pads provided.

(12) Insert the four round PCB pins into the *bottom* of the PCB, short end first, as far as they will go. Two of them can be trimmed so that they do not hit the modulator on the other side, but they will not cause any problems if they do. Solder them in place.

(13) Before going further, carefully check all the soldering. Look especially for dry solder joints, and solder bridges shorting the tracks together.

(14) Place the four insulating spacers on the PCB pins, wide end down, and place the camera module onto the pins. While holding the camera module down on the spacers, check that the spacing between the camera PCB and the main PCB is even all around, and not touching anywhere except on the spacers. Then solder the camera module to the pins.

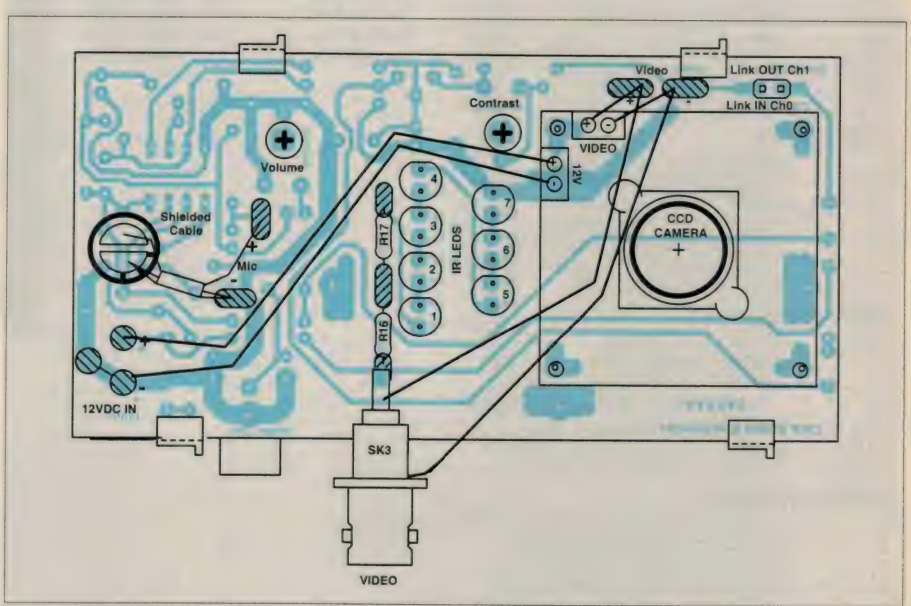
(15) Insert the two link pins into the bottom of the PCB, long end first, until about 1mm projects through the other side of the PCB. There should be a space between the plastic joiner of the link pins and the PCB. Solder the pins and slide the plastic joiner down against



The camera can be connected to a TV or VCR via either the RF output socket (top), to the antenna input, or via the video and audio outputs (bottom) to the direct video and audio outputs.

TABLE 1: Camera Module Specifications

Video system	CCIR
Optical sensor size	1/3" CCD (6 x 5mm)
Number of effective pixels	500(H) x 582(V) (290k)
Number of total pixels	537(H) x 597(V) (320k)
Scanning system	2:1 interlace
Synchronisation	internal
Resolution	400 TV lines
S/N ratio	46dB
Min illumination	0.2Lux (F=2.0)
Electronic shutter	1/50 to 1/100,000 sec.
Horizontal sync freq	15,625Hz
Vertical sync freq	50Hz
Video output	1Vpp/75ohms (BNC connector)
Built-in lens	focal length 3.6mm (f/2.0)
Storage temperature	-20degC to 80degC
Working temperature	-10degC to 60degC
Power source	12V DC
Power consumption	1.5W
Dimensions	38 x 38 x 24mm (H x W x D)



The CCD module, microphone, infra-red LEDs and their series resistors, and video output connections are all made to the copper side of the PCB.

the solder. Place the link over both pins for operation on channel 0, or on one pin only for channel 1.

(16) Solder the free ends of the camera DC lead to the tags of DC input socket SK1, ensuring the correct polarity as shown on the top overlay diagram. Plug the other end into the 12V socket on the camera PCB.

(17) Cut both of the camera module video wires at about 25mm from the camera plug end, then strip and solder the four resulting cut ends to the video (+) and (-) solder pads on the main PCB.

(18) Drill and ream/file the four socket holes in the side of the box using the template provided. The hole for the BNC socket SK3 should be made with flat sides if possible, to prevent the socket from rotating.

(19) Using a pair of side cutters or pliers, break off the plastic guides around the video output socket hole so that the washer, lug and nut can all fit on the back of the socket.

(20) Place the PCB assembly centrally inside the box without the tractor supports and check hole alignment and plug fit for the camera and sockets. Then remove the assembly from the box.

(21) Cut the tractor supports as shown in the diagram. The best way to do this is to place them one at a time on the PCB near the modulator, and trim the bottom level with the bottom of the modulator. Then place them in the box, touching the bottom, and trim the top to be a close fit with the lid.

TABLE 2: Voltages to check

Pin 4 of IC1	0V
Pin 8 of IC1	+10.5V
Pin 2 of modulator	+5.9V
Pin 1 of modulator	+2.4V
Video out	+0.1V
Anode of LED1	+8.3V

(22) Strip about 10mm of sheathing off both ends of the shielded cable provided and twist the braided shield. At both ends cut the braid only to about 4mm long, leaving the centre wire 10mm long.

(23) Insert the microphone into the lid (you can cement it in place later, using Araldite or similar cement) and solder the cable between the microphone and the microphone pads on the bottom of the PCB. The shield connects to the (-) microphone pad on the PCB, and on the microphone it connects to the pad joined to the microphone case. Solder the braid in a position that prevents it from shorting other tracks when the cable is moved around.

(24) Place the four tractor supports on the assembly, in the positions indicated on the overlay diagram and marked on the PCB. Then slide the assembly, socket side first, into the box, aligning the tractor supports as you go.

(25) Finally mount the BNC (video output) socket and connect it to the two wires from the video pads on the PCB.

Testing & adjustments

If you have a multimeter available, carry out the following tests before putting the camera to use.

With 12V connected to the DC input, the lens cap on and with VR1 and VR2 both set halfway, check the DC voltages shown in Table 2, with respect to the negative DC input terminal.

If all the measurements are within about 10% of the values shown, then your camera is probably working correctly and you can go ahead and test the camera on a TV or VCR. If one or more of the voltages are incorrect then disconnect the power immediately and make a thorough inspection of components and soldering.

The only adjustments necessary before using the camera are to set trimpots VR1 and VR2 correctly, for optimum video and audio performance. This is quite straightforward, involving in each case simply advancing the pots clockwise as far as you can before any degradation becomes obvious. If you advance VR1 too far, the picture on your TV or monitor will begin to 'bloom' on the brightest parts of the image, so when this happens back off a little until the image is fully clear again.

Similarly if you advance VR2 too far, the sound will become 'edgy' and distorted due to overload. So when this happens, back off the control a little until the distortion just disappears.

With these adjustments completed, your camera is finished and ready for use. ❖

PARTS LIST

Resistors

(1/4W 1% metal film unless otherwise stated)

ID	Value	Colour Code Three band	Four band
R0	0 ohm link	- Blk -	- Blk - -
R1	100 ohms	Brn Blk Brn	Brn Blk Blk Blk
R2	470 ohms	Yel Vio Brn	Yel Vio Blk Blk
R3	150 ohms	Brn Grn Brn	Brn Grn Blk Blk
R4,5	3.9k	Org Wht Red	Org Wht Blk Brn
R6,14	1M	Brn Blk Grn	Brn Blk Blk Yel
R7	27k	Red Vio Org	Red Vio Blk Red
R8	15k	Brn Grn Org	Brn Grn Blk Red
R9	820 ohms	Gry Red Brn	Gry Red Blk Blk
R10	270 ohms	Red Vio Brn	Red Vio Blk Blk
R11	4.7k	Yel Vio Red	Yel Vio Blk Brn
R12	150k	Brn Grn Yel	Brn Grn Blk Org
R13	1k	Brn Blk Red	Brn Blk Blk Brn
R15	68k	Blu Gry Org	Blu Gry Blk Red
R16,17	68 ohms	Blu Gry Blk	Blu Gry Blk Gld
VR1	1k 5mm horiz trimpot		
VR2	5k 5mm horiz trimpot		

Capacitors

C1	470uF 16VW RB electro
C2,4	0.1uF 50VW ceramic (100n, 0.1, 104)
C3	470uF 10VW RB electro
C5	100uF 16VW RB electro
C6	4.7nF 100VW greencap (.0047)
C7	2.2uF 100VW RB electro
C8	10uF 16VW RB electro

Semiconductors

Q1	BC549 NPN silicon
IC1	LM358 dual op-amp
D1	1N4007 1A/1kV silicon diode
D2	1N4148/1N914 silicon signal diode
ZD1	1N4745 16V 1W zener diode
ZD2	1N750 4.7V 400mW zener diode
LED1-7	LTE4208/CQY89A IR LED

Miscellaneous

1	Camera module CS-350S, with SK1,3 attached
1	VHF modulator UM1285AUS0
1	Electret microphone insert
1	RCA socket PCB mount (SK2)
1	Plastic box 125x60x40mm I.D.

2-pin snap-off pin header; 1 jumper shunt; four PCB pins, 1mm round; four transistor insulating bushes; 100mm shielded cable for mic lead.

Experimenting with Electronics

by DARREN YATES, B.Sc.

CMOS Circuits: The 4016/66 analog switch

This month, we look at one of the more unusual CMOS ICs. It's the 4016 analog switch, one of the few CMOS ICs that is adept at both digital and analog signals, and its brother the 4066. They're very handy chips indeed.

Two of the more unusual CMOS ICs have to be the 4016 and 4066 quad analog switch ICs. These ICs can handle both analog and digital signals and could really be called 'transmission gates'. They're designed so that when the control input is pulled high, the gate allows any signal through — i.e., closing the switch; and when the control input is pulled low, the gate is an open circuit, allowing no signal to pass.

Pretty simple, huh? In practice, they're easy to use so long as you follow a few small guidelines.

Why two of them?

The first question you're probably asking is why produce two ICs that do the same thing, pin for pin? Good question. The main reason has to do with how the ICs have been designed to operate when the switch closes.

The original 4016 transmission gate, even when closed had a closed-resistance of around 300 ohms, although this varies with supply voltage. 300 ohms may not sound like much, but when you need a low impedance, there are times when it just isn't low enough.

The 4066 improved this somewhat by reducing the closed-resistance to around 75 ohms. Still not perfect, but not bad anyway. We'll look at some circuits over the next couple of months where this closed-resistance is vitally important.

As with all CMOS ICs, you must make sure that the supply voltage doesn't exceed 15V. Same goes for any of the input pins.

While it's not necessary for digital signals, if you want audio or analog signals to pass through the switch without distortion, you must bias the input and output to half the supply rail. In this case, you can think of it as being needed for just about any analog circuitry. Other than that, you're free to use the IC in almost any way you wish.

In our circuit examples, we'll stick to using the 4066 since it really is the better chip of the two. If you have a couple of 4016 ICs in your junkbox, they'll slot straight in — but they may not quite work as well because of their higher resistance.

Some circuits...

Hopefully from the circuits we'll look at, you'll be able to see the versatility of this particular chip in both analog and digital situations. Before we get going though, to save things getting a little complicated, I've left off the power supply pins in a number of these circuits just to make it easier to see. Just remember that pins 14 and 7 must be connected to the supply rail and ground respectively, for the IC to work.

Starting off with a few simple digital circuits, Fig.1 shows how to use the 4066 as an AND gate. Because the gate has a control input, if we use the control input at pin 13 as one of the AND inputs and either of the switch feed inputs at pins 1 or 2 as the other AND input, you should be able to see that the remaining switch feed input will be the AND output. This works because it doesn't matter what's going on at either of the two inputs; they both have to be high for the output to be high — the basic rule for an AND gate.

The beauty here is that so long as you use pin 13 as one input, the other input can be either pin 1 or 2. The output will simply be the other pin. This can be particularly handy when you're laying out a PC board. You also get just as many elements in a 4066 as you do in a 4081 AND gate.

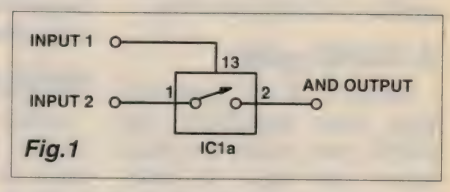


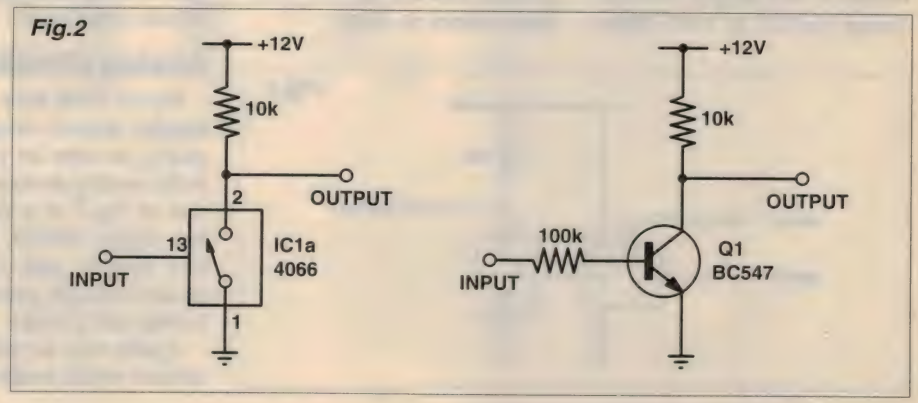
Fig.1

Simple inverter

The circuit in Fig.2 shows the 4066 used as an inverter. If you haven't already seen it, there are plenty of similarities between an NPN transistor and a CMOS analog switch, particularly when it comes to digital circuitry, and this circuit is a case in point.

On the left, we have the analog switch and on the right, the transistor. There's little difference except that the transistor's base input has a very low resistance without the current limiting resistor whereas the CMOS gate has something like 1 x 10^{12} ohms input impedance — and that's without a resistor. The down side is that the transistor only needs 0.7V to switch on, while the CMOS gate requires at least 2/3rds of the supply rail.

Fig.2



Being CMOS, the gate's control input can handle a switching frequency of up to 6MHz but no more. Pick the right transistor and you could easily go much higher than this.

As with everything, there are pluses and minuses to using either approach. But we'll see shortly that using the CMOS inverter can actually save precious board space and make your designs smaller and cheaper to run.

A NAND gate

Because of the extremely high input impedance, the CMOS gate makes for much better 'glue logic'. In previous columns, we've looked at how you can use transistors, resistors and diodes to make logic elements if you're in a tight spot. The problem that you'll run up against is that transistors and diodes don't have very input impedances, which produces loading problems on previous and subsequent circuit elements. So much so that the whole thing can come crashing down if you join too many of these home-brew gates together...

CMOS gates don't have that problem, so it is much easier to create our glue logic using these elements instead.

The circuit in Fig.3 shows a NAND gate made by combining the circuits from Figs.1 and 2. Again, the inverter input will not load down the output of the AND gate because of the former's high input impedance. It also results in full supply-voltage-swing signals at each stage, which makes for more reliable circuits.

The only problem is that it takes two of these gates to make a NAND gate, giving you a maximum of two per IC package. They're not the most efficient way of making logic elements, but it is much better to use these if you have a couple spare in your design, rather than add in another IC package. And they are much better than using diode/transistor 'throw-together' logic.

Schmitt trigger

A little trickier is the Schmitt trigger in Fig.4. This only relies on one gate and a few resistors to produce the same result as the more common 74C14 IC version. Looking at the circuit, pin 1 is tied to a fixed voltage which can, but need not necessarily be the supply rail; the other side of the gate at pin 2 is the output. The real action happens around the control input side.

The input is coupled to the control input at pin 13 via a 4.7kΩ resistor, however this is part of a voltage divider which also connects to the output at pin 2.

In this case, the output only goes high once the input voltage rises beyond the following level:

L-to-H: input threshold voltage = Vb x (1 + (R1/R2)) conversely, the output drops low on the following level:

H-to-L: input threshold voltage = Vb x (1 - (R1/R2)) where Vb is the fixed voltage and R1 and R2 are the resistance values in ohms.

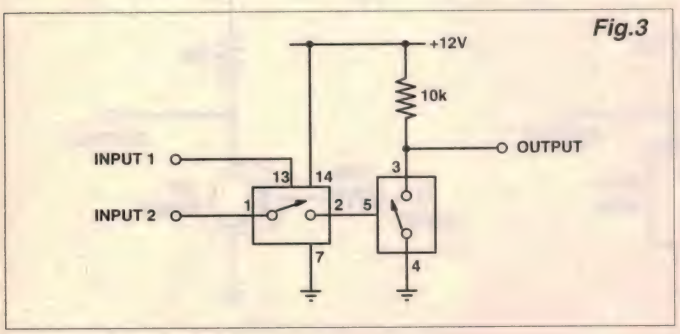


Fig.3

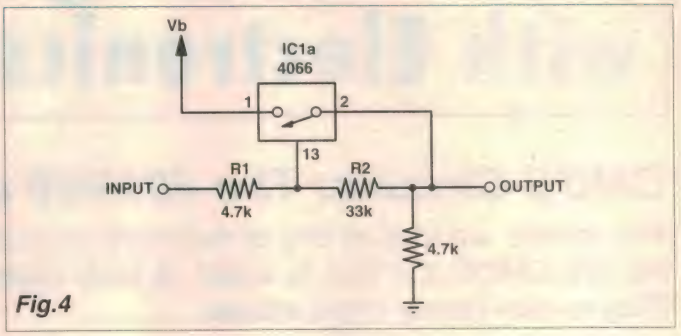


Fig.4

When the switch closes, the output is coupled back to the control input via the 47kΩ resistor, which mixes a portion of the fixed voltage in to push it further beyond the threshold voltage. It's not until the input drops some way below this original threshold that the output and the gate will switch low.

As you can see, this is one of the few situations where the input voltage can, and must, be higher than the supply voltage in order for this thing to work.

I really think that this circuit is in many ways much better than the Schmitt triggers you get inside a 74C14. Those gates have threshold voltages which change from chip to chip, whereas in this design they rely on the external components, which you can determine yourself.

Since every one of the parameters in these equations can be controlled externally, even down to the output voltage, this is one of those circuit elements that is very handy to have around — and well worth keeping in your circuit scrapbook.

Analog circuits

We've seen how the 4066 handles digital circuitry quite nicely, so now let's look at it in the analog domain. The circuit in Fig.5 is a simple analog signal switch. Press the ON button and the signal passes through; press the OFF button and it stops.

Again, this is one of those circuits which looks deceptively simple but in fact is a very clever design that works well and produces very little distortion — in the order of 0.1%.

IC1a is connected up as the analog switch, with the signal input at pin 1 and the signal output at pin 2. As we mentioned before, both sides of the switch must be biased to half the supply rail so that the signal passes cleanly. This is the job of the coupling capacitors and the biasing resistors.

Looking more closely, the input biasing arrangement is pretty simple: a couple of 22kΩ resistors form a voltage divider which does the job very nicely. However, unless the output bias voltage is exactly the same as the input side, we'll hear a click every time the switch closes or opens, because of simple variation in the components.

The sleight of hand we use here is to use the input to bias the output. And that's where the two extra 100kΩ resistors and the 10uF capacitor come in. Although there is a DC path between the input and output, the 10uF capacitor ensures that every snuff of signal disappears down the sinkhole. This way, the only audio to pass through comes via the switch itself.

That's the first bit. The second tricky part is how we get this circuit to work using simple push buttons.

The control input of IC1a is connected to the two switches S1 and S2. Note that the 22kΩ current limiting resistor ensures that the battery isn't nuked if both buttons are pressed acci-

dentally at the same time.

Also connected to the control input of IC1a is that of IC1b. Now it may look rather strange, but its control input is connected to its own output as well as IC1a's control input. What you also need to remember is the 22kΩ resistor to the supply rail from pin 3 and the 100kΩ resistor to ground.

Here's how it works.

When the ON button is pressed, the control input of IC1b is pulled high via the 22kΩ resistor and the ON switch S1. This allows the gate IC1b to switch on, which now also connects its own control input to the supply rail via the gate and the 22kΩ resistor connected to pin 3.

IC1b is now latched into the ON position, and the same output at pin 4 which keeps it closed also closes IC1a via its control input at pin 13. So audio now passes continuously through IC1a.

When the OFF switch is pressed, it simply grounds the control input of IC1b, which turns IC1b off, and also IC1a. The audio cannot begin to pass through until the ON button is pressed and the circuit is latched on again.

The 100kΩ resistor connected to both control inputs ensures that the circuit isn't operated from stray hum or glitches when the OFF button has been pressed.

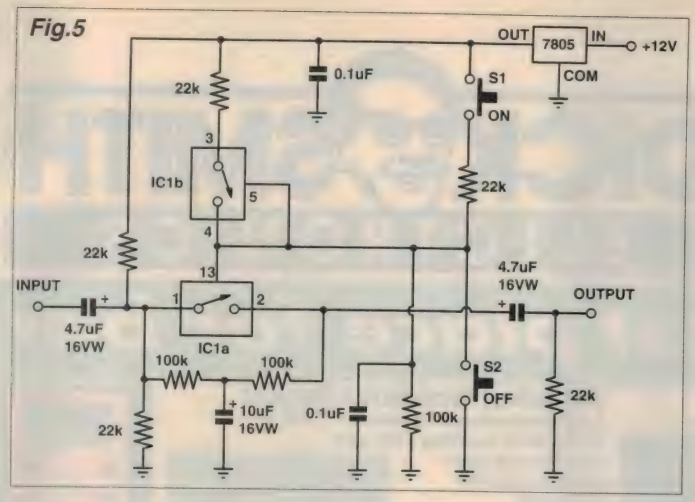
So here's a case where we have the same predominantly-digital circuit element type performing digital and analog functions, in the one circuit.

Digital mixer

Now that we have the ability to switch an audio signal on and off digitally, there are many new areas we can open up. One of those is digital audio mixing.

The circuit in Fig.6 is a case in point. This circuit uses analog gates to mix two audio signals together in a rather unusual way. The conventional method would simply be to use two resistors to mix the signal together. In this circuit, we use a method known as 'time-splicing' to mix the

Fig.5



signals together.

The way time splicing works is that one input is switched on for half the time and the other input for the other half of the time. Sounds simple in theory, but it's a little more complicated in practice. Obviously we could simulate this by hand using a mechanical switch, which in one position would allow one signal to pass and another signal in the other position. The problem is that we only hear one at a time. It also means that we miss what's happening on the other input when the current input is selected.

This circuit overcomes this by speeding up this switching action to the point where it is much faster than we could hear. In fact, the frequency is about 100kHz.

Digital theory

Digital theory says that we can reproduce all the necessary elements of a signal if we sample it at least twice as fast as the highest frequency in that sample. If we say our audio signal tops out at 20kHz, then we'd need to sample at least 40kHz. This 40kHz though is also present in the output, so it must be filtered out otherwise it would muck the audio up. But we have to do it in such a way that we don't lose any of our wanted audio bandwidth.

By the way, this is what happens in your CD player. It can handle the 20Hz-20kHz signal from your audio CDs because it samples at 44.1kHz. The benefit your CD player has is that it uses complicated digital filters to remove the sampling frequency.

By sampling at 100kHz, we are 'oversampling' which makes it easier to remove the clock signal and means we don't have to use complicated filtering.

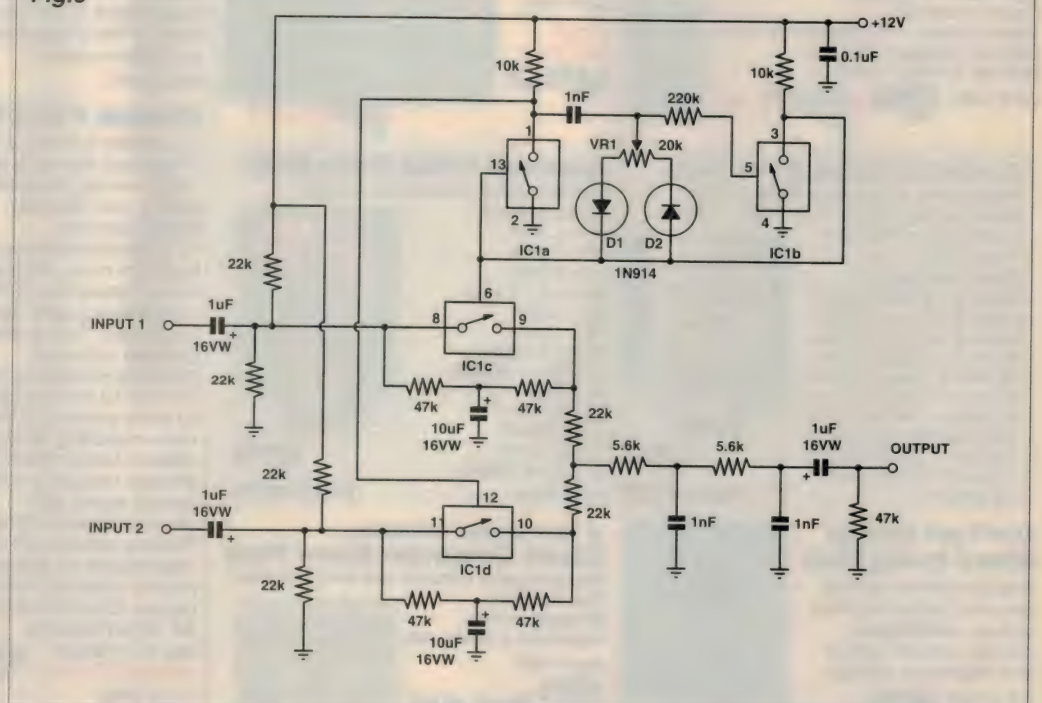
If CDs were recorded at 88.2kHz instead of 44.1, the filtering needed would be much simplified, however you'd only get a maximum running time of 37 minutes, not the 74 we now have because of the extra samples.

Getting back to the circuit in Fig.6, two 4066 gates (IC1a and b) form an oscillator with two complimentary outputs. These are connected to two further gates, IC1c and IC1d. Depending on the phase of the clock, one input will be open and the other closed.

With the duty cycle at 50%,

(Continued on page113)

Fig.6



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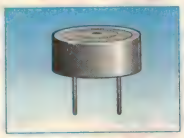

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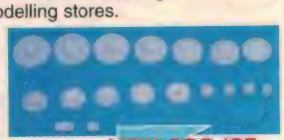

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57mm x 1.2mm x 1.2mm
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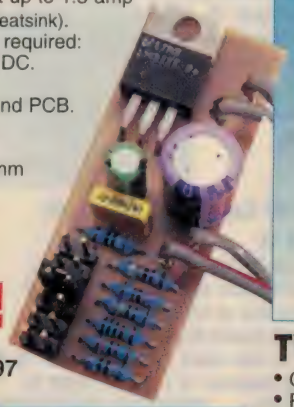

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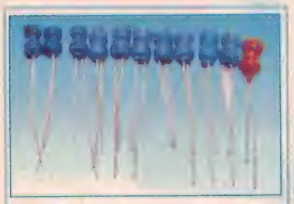

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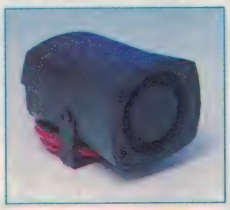

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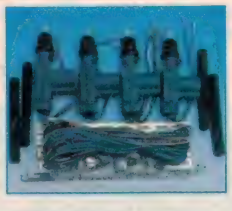

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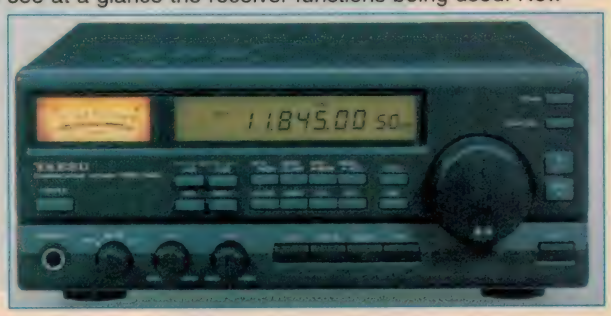

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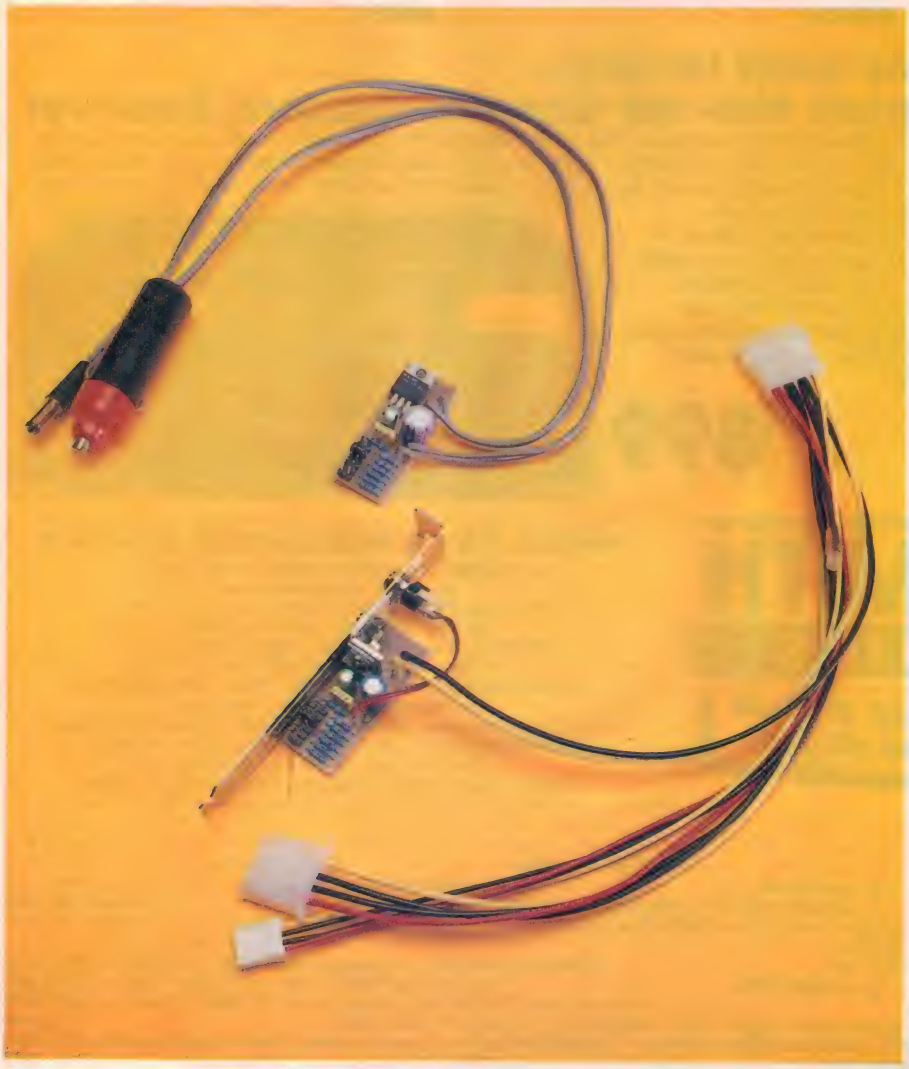
Construction project:

VERSATILE LOW VOLTAGE ADAPTOR

This little project is just the shot for those occasions where a low-voltage regulated DC source is needed from a small package. Based on a robust but low-cost regulator IC, the adaptor uses push-on jumper links to preset the output voltage between 3V and 15V, and depending on the heatsink you use, can deliver an output current of up to 1.5 amps. You can use it to power external peripherals from a PC, or to run a personal CD player from a car's cigarette lighter socket.

by ROB EVANS

As with many small projects of this nature, the voltage adaptor presented here was developed in response to a range of requests from readers, all of which had a common underlying theme. In this case there appeared to be a clear need for a small, low-cost and flexible DC power circuit that could be easily adapted to a wide range of tasks. And as there really didn't appear to be anything currently available to satisfy that need, we set about developing a suitable circuit.

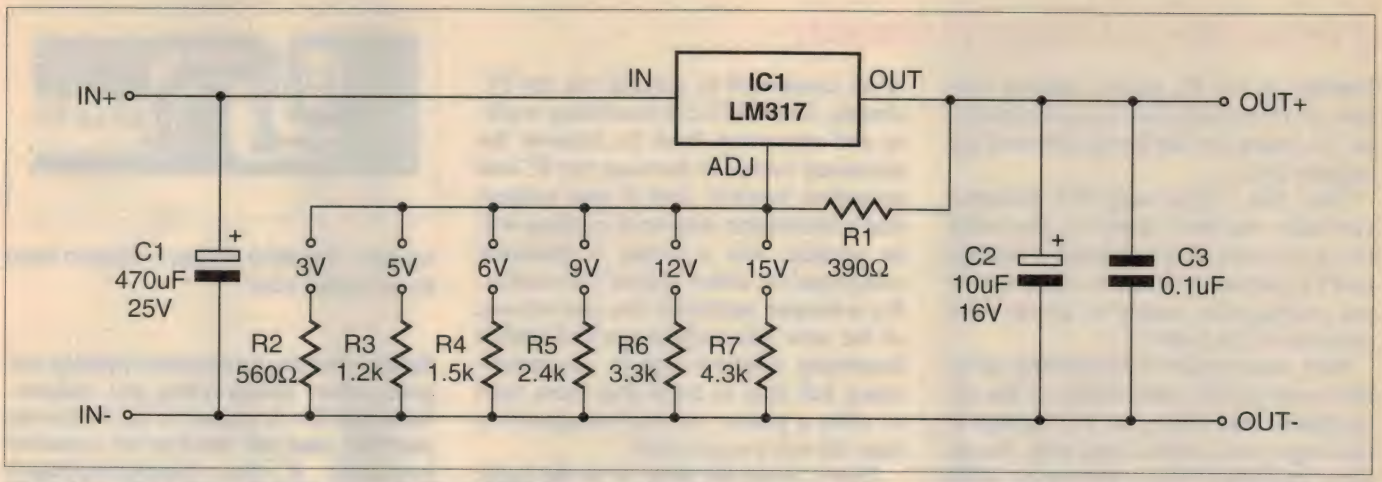


The resulting DC supply module uses just a handful of low-cost components, is very easy to put together, and offers enough flexibility to make it suitable for a wide range of jobs. As you can no doubt tell from its schematic diagram, the circuit itself doesn't break any new ground and has been designed in a fairly basic but functional way around a common LM317 adjustable three-terminal regulator.

For those who may not be familiar with the LM317, all we really need to point out for this application is that it's quite a hardy beast featuring both temperature and current overload shutdown, and is designed for circuits where an adjustable output voltage is needed. In our voltage adaptor, the regulator's output voltage is set by fitting a jumper link to one of six positions on a PC-mount header strip, and its output current capability (up to around 1.5 amps) is largely determined by the size of the IC's heatsink.

To illustrate a couple of quite different ways that the voltage adaptor can be used in practice, we have built up two prototype units to present in this article. As you can see from the associated photographs, one unit has been constructed in a very compact form with the (unheatsinked) LM317 lying flat on the PCB and flying leads used for the DC input and output connections.

This arrangement works well as a low-powered DC converter for in-car applications for example, where you need a reliable low-voltage source for a portable CD player or similar battery-powered device. It would need to be installed in a suitable case of course (there is room to spare when it's housed inside the smallest zippy/jiffy box), and the flying input/output leads will need to be terminated in suitable



There's really not much to the circuit. The LM317's output level is determined by the voltage divider formed by R1 and one of R2 to R7, where a single link sets Vout to 3, 5, 6, 9, 12 or 15 volts.

connectors, such as those shown on our prototype.

Our other voltage adaptor has been built up as an internal power adaptor for PCs, where the circuit board assembly is mounted onto an I/O slot backing plate via a small heatsink/bracket arrangement. As you can see from the shots of that unit, here the regulator chip has been fitted vertically to allow for the bracket, and the adaptor's DC output is passed directly to a panel-mount 2.1mm socket.

Once installed in a PC, this adaptor's DC input is derived from the computer's own power supply via suitable 'disk drive cable' connectors (as shown in the shots of our unit), and can therefore supply power to an external device whenever the PC is on. This is an ideal power source for a range of PC peripherals such as powered speakers, modems, music keyboards, Zip drives, and so on — all in all, quite a handy gadget.

Quite apart from our two prototype arrangements, of course, the voltage adaptor can be used in a host of other applications where a compact DC power source is needed. Since the basic unit is both inexpensive and easy to build, there would be a strong case for having a couple of assembled adaptors on hand for when the need arises...

Circuit description

As you can see from the voltage adaptor's schematic diagram, the circuit is quite a conventional arrangement based on the LM317 three-terminal regulator IC. The output voltage level is set by simply shorting one of the jumper links at IC1's adjust pin, which in turn connects an appropriate resistance value (R2 to R7) to the negative line.

The LM317 itself is essentially a 1.25V regulator which passes a very small and consistent current (typically 50uA) through its reference (ADJ) pin, and returns virtually all of its internal biasing current into the load via its output pin. Thanks to these design attributes, the 317 is ideally suited to variable supply applications where the reference pin voltage is simply 'jacked up' by a suitable resistor network.

In our circuit, this is done by the voltage divider formed by R1 and the resistor selected by the voltage setting jumper link. As you can see, the '3V' setting connects R2, the '5V' link places R3 in circuit, and so on.

Since the LM317 develops a fixed 1.25V reference between its output and adjust pins, there will be a constant current of 3.2mA flowing through R1 (1.25/390) and 3.2mA plus 50uA (from IC1's ADJ leg) returning to ground via the chosen voltage-setting resistor. If this is say 2.4k (9V selected), there will then be a voltage drop of 7.8V across R5 (3.25mA x 2.4k) and a resulting output voltage of 9.05V (7.8V + 1.25V).

The other settings work in the same manner as you would expect, and can be calculated using the expression:

Vout = 1.25 x (1 + Rset/390)
+ (Rset x 50uA)

where Rset is the selected voltage setup resistor (R2 to R7).

Other than that, there is little else to the circuit. The remaining parts include C1, which provides a degree of filtering to the raw DC input voltage, plus output bypass capacitors C2 and C3. Note that the voltage rating of C1 will really depend upon the expected input voltage in your application, but unless you plan to apply an unusually high source voltage (the LM317 itself is rated at 40V) a 25VW electrolytic should suffice. As it happens, we used a 16VW type for our PC voltage adaptor version, since the input level is known to be 12V.

Construction

The voltage adaptor is really quite straightforward to construct and as you can see in the component overlay diagram, uses a very small circuit board (PCB) which holds all of the components, including the LM317. The PCB itself measures 19 x 52mm, is coded 97va8, and uses a small section of standard header strip as the voltage selector jumper block — shown as J1 on the diagram.

Before starting construction you will need to decide on the best physical arrangement for your needs, as this will determine how LM317 is mounted. The two basic arrangements are illustrated in our prototype units, where IC1 is installed vertically and bolted to a small

A larger than life shot of the car power adaptor version, which is very small but has a modest current capability.

bracket on the PC power adaptor version, or fitted flush (that is, horizontally) on the board for the lower-powered car adaptor style.

Note that if you want IC1 mounted vertically *and* hard down on the board (as in our unit), you may need to enlarge its PCB mounting holes to allow for the pin skirting that seems to be on most versions of the LM317.

Start construction by installing all of the lower-profile components on the circuit board and work your way though to the larger parts, in the usual way. As we have specified close tolerance (E24 series) resistors for this project, we'd recommend that you use a multimeter to check the value of each resister as it's fitted, since the markings on this type are often difficult to read. Other than that, refer to the component overlay diagram for the positioning of all components, and take particular care with the orientation of electrolytics C1 and C2.

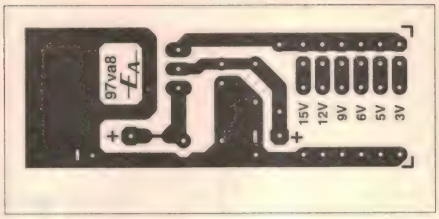
For the PC voltage adaptor version we fashioned a small heatsink/mounting bracket from a scrap of aluminium plate, and bolted this between the LM317 flange and the PC I/O slot backing plate as shown. Note that the 317's metal flange is directly connected to its output pin and therefore needs to be electrically insulated from the mounting bracket, which will ultimately be connected to ground via the PC chassis. Use a TO-220 insulating washer and mounting bush to achieve the necessary isolation between the IC and mounting bracket, and if you suspect that a reasonable degree of cooling will be needed, add a smear of heatsink compound on either side of the washer. For a simpler approach you can use one of the new silicon-impregnated rubber insulating washers (as in our prototype), but bear in mind that these tend to offer a poorer thermal conductivity than the mica equivalent.

That's about all there is to the basic construction process. As you can see from our PC adaptor version we've used a PC disk drive power connector lead to pass +12V to the unit (the +5V lead was trimmed and insulated), and a panel-mount 2.1mm socket for the output connection. Note that as the latter socket is not an insulated type, it must be wired with the positive output lead connected to the centre pin.

The car voltage adaptor version uses a conventional cigarette lighter plug as the input connector, as you can see, and an in-line 2.1mm DC plug has been used to terminate the output lead. You can fit whatever connector will suit your appliance of course, but as with all of the other plugs and sockets you will need to pay particular attention to the polarity of the connections. You may even like to fit a protection diode in series with the power input lead, if there is a risk of a reversed polarity connection.

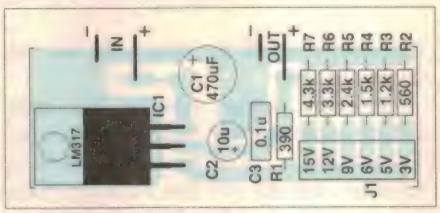
As a last point to bear in mind, note that due to the internal design of the LM317 it will drive its output voltage to a high level if the path between the adjust pin and ground is broken. This in turn means that if the voltage selection jumper is *not* connected at all for some reason, a potentially damaging voltage level may appear at the voltage adaptor's output.

As this occurs for a short time when the jumper is being moved to a different voltage selecting link, we strongly recommend that the load should *not* be connected to the unit during this process. ❖



Above: The PCB artwork, shown here at its actual size.

Below: Use this component overlay diagram when constructing the adaptor. Note that IC1 is shown in its horizontal position, and will need to be mounted vertically if the bracket-heatsink arrangement is used.



The PC power adaptor version is mounted on a standard I/O slot backing plate via a small aluminium bracket. IC1 must be electrically isolated from the metalwork, while the output socket should be wired with the centre pin as positive — this is not strictly necessary if you use an insulated 2.1mm socket.

PARTS LIST

Resistors

(All 1% tolerance)

R1	390 ohms
R2	560 ohms
R3	1.2k
R4	1.5k
R5	2.4k
R6	3.3k
R7	4.3k

Capacitors

C1	470uF 25V electrolytic
C2	10uF 16V electrolytic
C3	0.1uF MKT or monolithic

Semiconductors

IC1	LM317 regulator

Miscellaneous

J1 6-way header strip, plus jumper
PCB coded 97va8 (19 x 52mm), PCB pins (optional), hookup wire.

NEW BOOKS

Soldering technology

MODERN SOLDER TECHNOLOGY FOR COMPETITIVE ELECTRONICS MANUFACTURING, by Jennie S. Hwang. Published by McGraw-Hill, 1996. Hard cover, 235 x 156mm, 622 pages. ISBN 0-07-031749-6. RRP $165.00.

A thorough and comprehensive reference to modern soldering and the associated technologies used for both electronic and microelectronic packaging and assembly. Author Dr Jennie Hwang is a recognised world authority in this area, and a consultant to the US military, major OEMs and SMT manufacturers. She has previously written *Solder Paste in Electronics Packaging* and *BGA & Fine Pitch Peripheral Interconnection*, both well respected references in the field, and has been both president and a board member of the US Surface Mount Technology Association.

There are some 20 chapters in this work, covering virtually every aspect of modern soldering, packaging and assembly — from environmental considerations right through to detailed metallurgical microstructure analysis techniques. Most of us in the industry probably wouldn't have dreamed there were now so many aspects of soldering, surface-mount and packaging technology, and how much detailed knowledge is now required for efficient and professional manufacturing!

Dr Hwang takes us through it all in a highly organised and methodical fashion, and seems to cover just about every conceivable aspect of soldering, IC packaging and electronic assembly. She gives a huge amount of reference data along the way, including many informative and interesting shots taken via an SEM (scanning electron microscope).

For those who need to keep up to date in this area, it's probably an essential reference. The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)

Digital IC reference

DIGITAL LOGIC IC POCKET BOOK, by R.M. Marston. Published by Butterworth Heinemann, 1996. Hard cover, 95 x 195mm, 400 pages. ISBN 0-7506-3018-3. RRP $35.95.

This excellent book suffers from one basic problem: the pages are so narrow, it's almost impossible to keep the book open at the page you want to read. That said, in all other respects it achieves what its title says, describing and giving applications for over 185 of the 74 series and the 4000 series of digital ICs. It has some 600 diagrams and 15 chapters and should prove useful to anyone working with digital ICs.

The first three chapters explain the basics of digital ICs, including TTL and CMOS principles, and today's main subfamilies of the 74 series (LS and HC). Chapters 4 and 5 cover CMOS principles and CMOS ICs, while the next chapter deals with logic circuitry including logic symbols and mathematics, along with data for some of the ICs.

Later chapters progress through bilateral switch ICs, waveform generator circuitry, clocked flip-flop and counter circuits, special counter-dividers, data latches, registers, comparators and code converters. Chapter 14 then covers specialised ICs such as multiplexers, demultiplexers, addressable latches, decoders, full adders, bus transceivers, priority encoders and rate multipliers. The final chapter presents a miscellaneous collection of digital circuits.

There are pin diagrams for ICs throughout the book and typical applications with circuit diagrams. The writing style is friendly and informative.

The book should prove useful to both beginners and professionals, and because it is up to date, it covers today's ICs, such as the 74HC40193 and even the CMOS 555 timer.

The review copy came from Butterworth Heinemann, PO Box 251, Port Melbourne 3207. (P.P.)

Microwave repair

TROUBLESHOOTING & REPAIRING MICROWAVE OVENS, by Homer L. Davidson. Fourth edition, published by Tab Books (McGraw-Hill) 1997. Soft covers, 235 x 187mm, 514 pages. ISBN 0-07-015767-7. RRP $49.95.

This is the fourth edition of Homer Davidson's book on servicing microwave ovens, testifying to its popularity. So far it has apparently sold over 40,000 copies, putting it into the 'best seller' category among technical books.

Homer Davidson is of course a prolific US technical author, with many articles and books to his name, and this one certainly provides a lot of down-to-earth practical information on microwave oven servicing. It's quite comprehensive, and in this fourth edition he has both updated and expanded a lot of the material.

Although it's primarily written for the US market, and all of the models discussed are those sold in that market, I believe much of the material presented would still be of great value to the reader over here. It's all clearly written, with plenty of illustrations, and the techniques presented should in many cases be equally applicable to local brands and models (some of which will be very similar, of course).

Whether you're a service tech who needs to repair microwaves faster, or an amateur who only wants to repair your own, it's likely to be of considerable value. Just make sure you read the warnings about safety!

The review copy came from McGraw-Hill Australia, of PO Box 236, Roseville 2069. (J.R.) ❖

Construction Project:

AUDIO FREQUENCY SHIFTER

Here's a new low cost design for a unit which can be of great assistance in controlling acoustic feedback ('howl-round') in public address and other sound reinforcement systems. It operates by shifting the audio spectrum by 5Hz, and features very low noise and distortion over a full 20Hz to 20kHz bandwidth.

by PHIL ALLISON

Anyone who has ever used or heard a PA (public address) system in an auditorium will be familiar with the phenomenon of acoustic feedback or 'howl-round', whenever the gain control is set at too high a level. Typically an ear-shattering screech comes from the speakers until the operator reduces the system gain; even then ringing at various frequencies can often be heard whenever the person addressing the gathering speaks into the microphone.

Acoustic feedback occurs when the sound finding its way back to the microphone position from the loudspeakers is equal or more in level to that coming from the voice of the person at the microphone. The 'system gain' is then said to exceed unity and positive feedback creates full power oscillation at a resonant frequency of the entire room and PA system.

A variety of remedies for acoustic feedback exist, including the use of directional (i.e., cardioid) microphones and the careful placement of loudspeakers to minimise the sound level arriving back at the microphone. Also a graphic equaliser can be placed in the audio chain, to smooth out the overall response. These methods are effective to varying degrees, but much less so in rooms with noticeable echoes, where reverberation becomes the major cause of feedback problems. The non-directional nature of reverberation means that sound will approach even a cardioid microphone on its front axis and largely negate any placement scheme.

Readers should be aware that the vast majority of rooms and auditoriums have significant amounts of reverberation. Only heavily acoustically treated rooms like recording studios or open air situations are reverberation free.

Why shift frequency?

Now there is an important but little known fact about the acoustics of rooms and auditoriums. If a frequency response sweep of a room is done VERY slowly, it is found to have a fine structure of minor resonances, superimposed on the usual much broader major ones. This fine structure consists of sharp peaks and dips about the average level, each one separated by only a few hertz, right up and down the audio spectrum (see Fig.1).

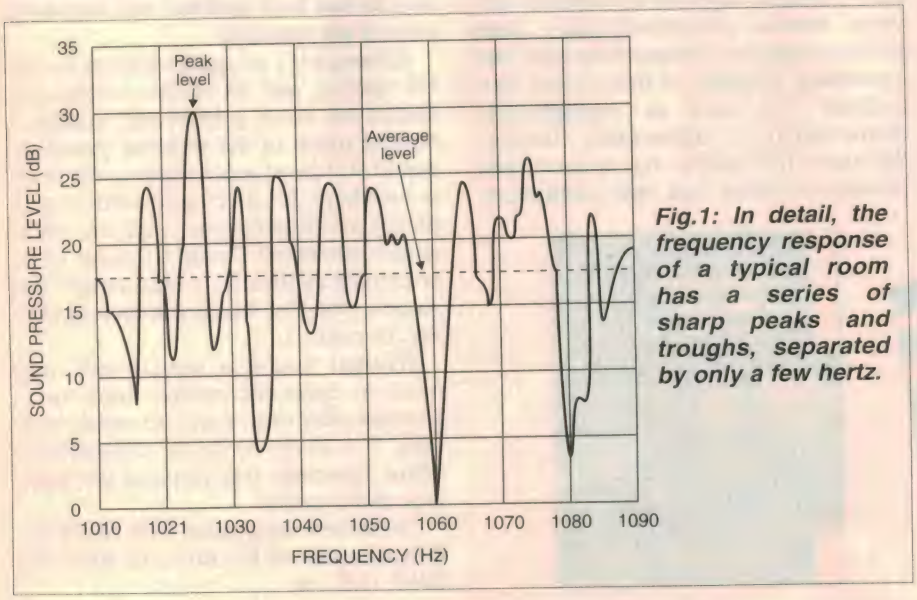


Fig.1: In detail, the frequency response of a typical room has a series of sharp peaks and troughs, separated by only a few hertz.

Specifications

Frequency shift:	4.8Hz upwards
Frequency range:	
Shift on	22Hz to 24kHz within 0.5dB
Bypass on	22Hz to 100kHz within 0.5dB
Input impedance:	10k unbalanced, 20k balanced
Output impedance:	100 ohms, minimum load 600 ohms
Nominal input:	1V RMS (11dB headroom)
Maximum input:	3.5V RMS
Maximum output:	3.5V RMS
Noise level:	
Shift on	-82dB ref 1V, unweighted
Bypass on	-106dB ref 1V, unweighted
Total Harmonic Distortion:	
Shift on	0.07% at 1kHz and 2.5V (2nd harmonic)
Bypass on	0.001% at 1kHz and 2.5V
10Hz modulation:	Maximum 2%
5Hz residual:	Less than 3mV RMS at output
Mains Supply:	200 - 250V AC, 5VA

These narrow band resonances are caused by standing waves set up between the walls and other parallel surfaces of a room. They seriously exacerbate acoustic feedback problems when a PA system is used and can limit the available gain before feedback occurs in even the best systems by 10dB.

However, the really interesting fact is that the frequency spacing of these resonances is a constant number of hertz, characteristic of the room and its reverberation time. Generally for most auditoriums the spacing of adjacent peaks is about 10Hz, or 5Hz between adjacent peaks and dips.

If the whole audio spectrum of the signal from the microphone could be shifted by about 5Hz, then the effect of these peaks would be eliminated. A sound going around the microphone-speaker-room loop is no longer reinforced each time at a (minor) resonant frequency, but

The author's prototype is housed in a low-profile plastic instrument case, but an alternative would be a metal rack-mount box. The switch allows easy audio bypassing if desired.

actually diminishes instead — with each peak being alternately replaced by an adjacent dip. This principle is the basis of frequency shifting.

In fact, frequency shifting as a method of acoustic feedback reduction is well established, having been used since the 1960s. Typically 6dB more usable gain before feedback is obtained in practice, as well as a much more stable situation with no ringing on speech in near feedback conditions. As well, the improvement is independant of varying the microphone position and whether a room is empty or full of people.

There is no set-up procedure or skill required to use a frequency shifter, and the full benefit can be obtained no matter what other methods of feedback reduction are in place.

Extensive testing has shown that a 5Hz up-shift is at the threshold of perceptability on speech, and recorded music sounds quite normal when reproduced through the prototype. Similar units have been successfully used with the high powered monitor systems used for stage performances of live bands.

The design presented here produces a 5Hz shift across the 20Hz to 20kHz range and beyond, with very low noise levels and THD (total harmonic distortion) below 0.1%. It uses modern, readily available ICs and requires only minimal adjustments to be fully aligned and ready to use.

While this Audio Frequency Shifter (AFS) is not unique, the designer is unaware of any similar unit being commercially available in this country. 'Shifters' are sold in the UK, and also the USA and possibly other countries, but Australian PA owners have been strangely reluctant to try them. Or perhaps they've never heard of them, and hence there is no demand and no products on sale!

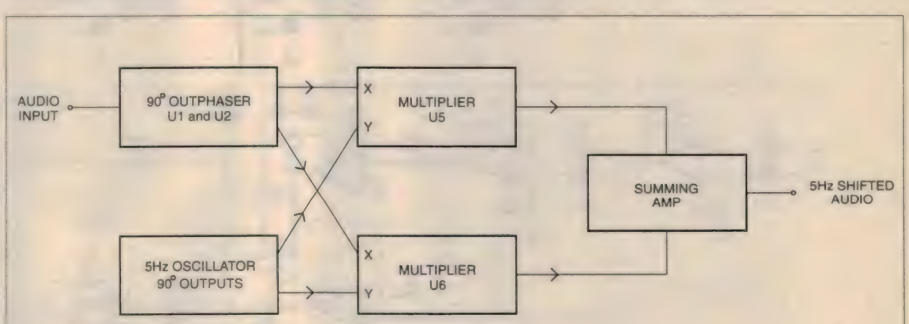


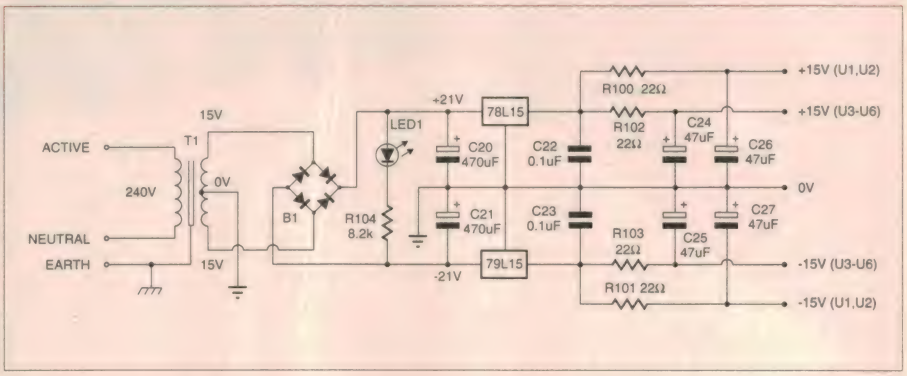
Fig.2: The shifter works by splitting the incoming audio into components with a 90-degree phase difference. These are fed to four-quadrant analog multipliers, along with the signals from a 5Hz oscillator, with a similar phase difference. The two multiplier outputs are then added, leaving a single output 5Hz higher in frequency than the incoming audio.

AFS design outline

In the AFS the input signal is fed into two complementary phase-shift networks called the 'outphaser', whose outputs are 90° phase shifted with respect to each other over a 20Hz to 20kHz range, whilst maintaining a flat amplitude response. Then two analog multiplier ICs are used to multiply the two audio signals with a fixed 5Hz oscillator and a 90°-shifted version of the same 5Hz signal. The two multiplier IC outputs are then summed to produce the desired output (see Fig.2).

For example, when an input signal at 1000Hz is multiplied by the 5Hz signal in U5 the resulting output consists of two sidebands, the sum and difference signals at 1005Hz and 995Hz. Similarly the other multiplier U6 produces the same two frequencies; but because the two 995Hz signals are 180° out of phase and the 1005Hz signals are in phase, the former cancel in the summing stage leaving only the 1005Hz signal. An exactly similar arguement applies for any audio frequency fed into the AFS, so the nett result is that all audio frequencies emerge shifted 5Hz higher.

Note that reversing the multiplier inputs of either the audio or low frequency signals will produce a 5Hz *downward* shift, as would changing the summing stage into a subtracting one.



The power supply is quite straightforward, as you can see. The rails for U1 and U2 are decoupled from those for the rest of the circuitry.

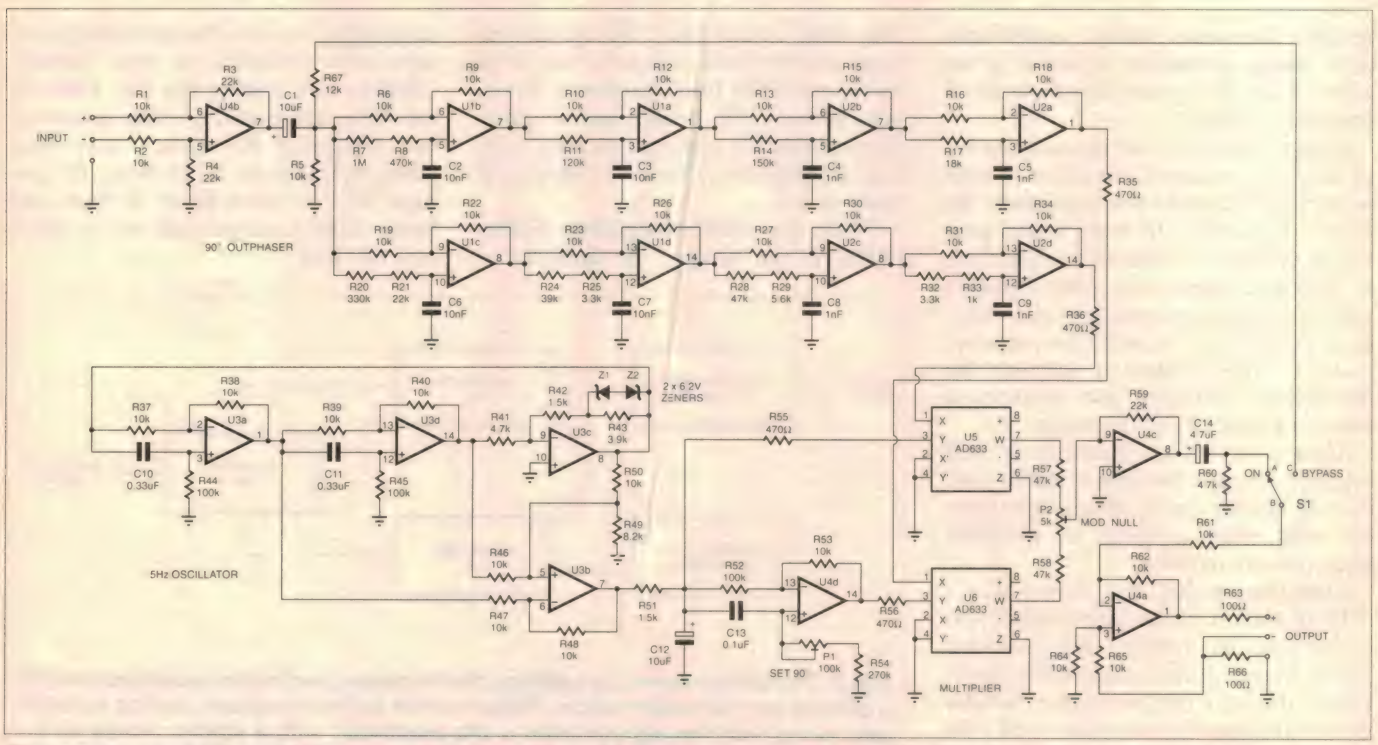
Circuit details

Referring now to the circuit diagram, the input buffer (U4b) is a simple differential stage which can be used for either balanced or unbalanced inputs and has a gain of 2.2 times. The overall gain is later restored to unity in the output stage — a noise reduction measure.

The outphaser employs two TL074 quad Bi-FET op-amps U1 and U2, with all eight op-amp sections connected as unity gain all-pass filters in two chains of four stages. An all-pass filter rotates the phase of an input through 0 to 180° over its operating frequency range, whilst leaving the amplitude unchanged (see notes 1 and 2).

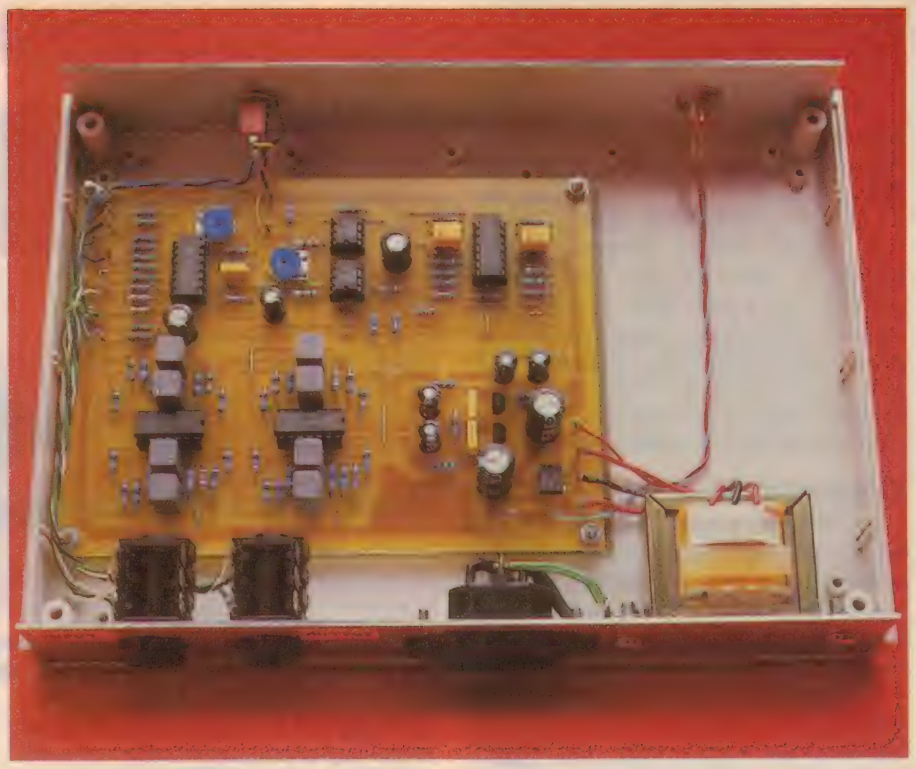
Each stage in the two chains has been carefully chosen with staggered poles or frequencies where the phase shift is exactly 90°. The total phase shift through each chain exceeds 720° at supersonic frequencies, however in the range from 20Hz to 20kHz the important 90° difference is maintained to within a 2° error margin.

Note that for proper operation of this circuit it is **essential** that 1% tolerance components are used, including poly-



The op-amps of U1 and U2 are used to form the wideband outphaser, splitting the incoming audio into two components with a 90-degree phase shift. Those in U3 are used to form the 5Hz oscillator, while U4d derives the 90-degree shifted oscillator output.

There is no crowding inside the prototype case. A rectangle of unetched PCB laminate, connected to earth, is mounted underneath the main PCB to provide a measure of shielding.



styrene capacitors of 1% tolerance or else selected on test from 5% stock.

The multiplier stage uses two Analog Devices AD633 'four quadrant' multipliers ('four quadrant' means it operates with both polarities of both inputs). These eight-pin DIL ICs (U5, U6) are complete circuit blocks in themselves, requiring no external components or fussy adjustments. They have been laser trimmed during manufacture to eliminate offsets and offer low distortion and noise levels. The multiplier 'X' inputs are used here for the two audio signals from the outphaser, while the 'Y' inputs receive the two 5Hz oscillator outputs.

The AD633 operating equation is:

Vout = (Vx . Vy)/10

This equation means that the output voltage is the product of the instantaneous values of the two input voltages, having regard for polarity, divided by a scale factor of 10. The IC's small signal bandwidth is specified as 1MHz, with a slew rate of 20V per microsecond, so an audio signal presents no problems.

Having the 1:10 scale factor means that to achieve operation with overall unity gain, one of the signals must have an amplitude of 10 volts. This is the case with the 5Hz oscillator, whose output level at the multiplier inputs is very close to 10V peak.

The oscillator circuit will be familiar to some readers as a revamp of the Miniosc design (*EA* December 1996). Operating now from +/-15V supplies and using another TL074, the output frequency and also level are fixed, the latter by using back to back 6.2 volt Zener diodes.

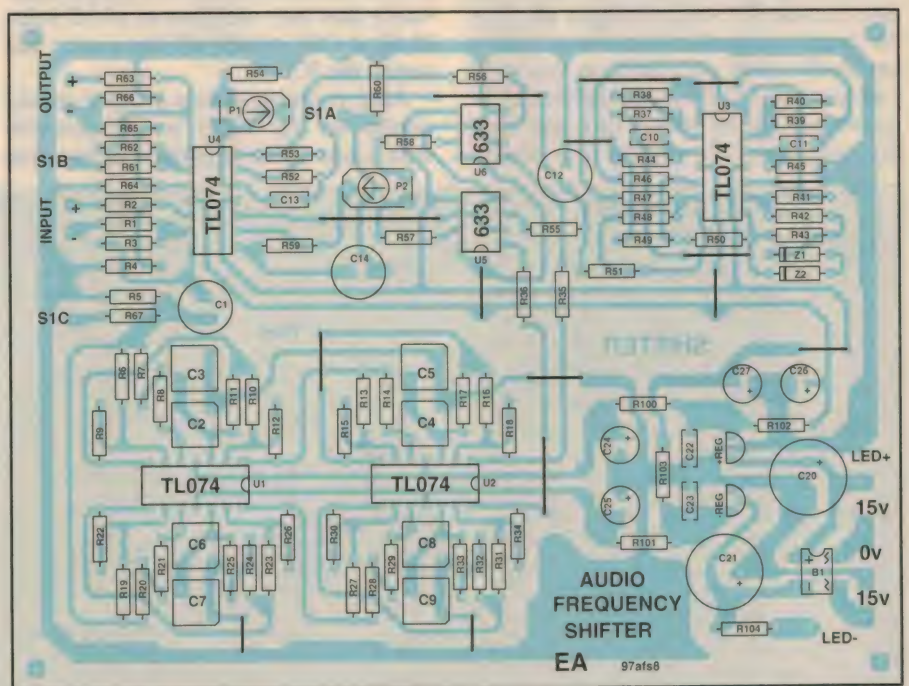
As before, the combining stage U3b operates to substantially cancel third harmonic distortion caused by the use of the zeners. This feeds a low-pass filter network formed by R51 and C12, to further reduce harmonics to about 0.1%. It then drives U4d, connected as single stage all-pass filter, which is adjusted to produce exactly 90° phase shift at the frequency of the 5Hz oscillator by use of trimpot P1. The input and output signals of the all-pass filter are used to drive the 'Y' inputs of the two multiplier ICs.

The outputs of the multiplier ICs are summed by U4c, with trimpot P2 used to compensate for any small mismatch in levels occurring up to this point, due mainly to resistor tolerances. The gain here is 0.45, to compensate for the 2.2 times gain at the input.

Finally the output buffer U4a is connected in a psuedo-balanced configuration, with ground compensation on R66 to drive balanced input circuits. Switch S1 acts to bypass the whole circuit by connecting the output buffer directly to the input buffer.

Power supply

The power supply is straightforward using a centre tapped 30V AC, 150mA transformer with a bridge rectifier and IC regulators to produce +/-15 volts supplies for all the ICs. The total circuit drain is about 40mA, so TO-92 style 100mA regulators easily suffice. The circuit is largely immune to supply rip-



Apart from the audio connectors, power transformer, bypass switch and LED, everything fits neatly on the well laid-out PCB. Use this diagram as a guide when you're wiring your own board.

ple, so the regulators are mainly to stabilise the voltages — particularly for the 5Hz oscillator, which must not clip the +/-11V peak signal at its output.

A simple plastic instrument case houses the prototype, but readers may prefer to use a rack-style metal cabinet with 'Cannon' type connectors, for that professional audio look. Or alternatively you could install the PCB and transformer inside an existing PA amplifier case, where there is sufficient room.

Construction

The PCB should be carefully checked for bridges between tracks and missing holes before you begin loading components. Holes for PC pins and the two trimpots may need to be enlarged, and the four mounting holes drilled to size.

Using the overlay diagram start by loading the resistors — after first double checking the values with your digital multimeter, as 1% four band resistors are sometimes ambiguous.

I recommend the use of IC sockets, provided they are the 'dual wipe' variety or else have machined pins. After these have been fitted then the capacitors, power supply components, links and PC pins may be installed.

When you have finished, double check for correct orientation of the diodes, capacitors and IC sockets and again check for solder bridges all over the board, using your ohm-meter where any doubt exists. At this stage I suggest you wash the PCB with methylated spirits, to remove all solder flux and then dry with a hot air gun on low power.

The audio input and output connectors are mounted on the rear panel, along with the mains connector. XLR-type audio connectors can be used if you prefer.

Cleaning the board like this will help reveal any remaining whiskers of solder and sub-standard joints.

Commissioning

Since the board is self contained, it may easily be tested before installing in your case. Simply connect the switch S1 as shown, the transformer and your bench audio generator (or Miniosc) and a CRO if one is available. Do not install the DIL ICs for the moment, but apply power and measure the two supply rails; verify that they are close to +/-15 volts. If all is OK, switch off the power and install the ICs.

After restoring power a signal should appear on the CRO screen probably with some 10Hz amplitude modulation visible. If this is not the case, check the +/- 15 volt rails again. If they are OK then use an analogue multimeter or CRO to check that the 5Hz oscillator is working with 8 volts rms on all output pins. The other op-amp and multiplier IC outputs should be at zero volts DC (+/- 20 mV). To stop the 5 Hz oscillator simply short together the positive ends of the two zener diodes.

When the unit is operating normally the input and output levels are virtually the same in either position of switch S1, and any slight 10Hz amplitude modulation can now be adjusted to minimum by use of trimpots 1 and 2. If no CRO is available, then a moving-coil VU meter or AC voltmeter may be used to detect the amplitude modulation — provided it has

PARTS LIST

Semiconductors

U1-4	TL074CN quad op-amp
U5,6	AD633JN four-quadrant multiplier
Z1,2	6.2V 400mW zener diode
REG+	78L15 15V positive regulator
REG-	79L15 15V negative regulator
B1	1A bridge rectifier, DIL package
LED	Red or green LED in bezel

Resistors

1% metal film, 0.25 watt:

R100-103	.22 ohms
R63,66	.100 ohms
R35,36,55,56	.470 ohms
R33	.1k
R42,51	.1.5k
R25,32	.3.3k
R51	.4.7k
R29	.5.6k
R49	.8.2k
R67	.12k
R17	.18k
R3,4,21,59	.22k
R24	.39k
R28,57,58	.47k
R44,45,52,53	.100k
R11	.120k
R14	.150k
R54	.270k
R20	.330k
R8	.470k
R7	.1M
(Plus	.31 x 10k resistors 1%)
R104	8.2k .5% carbon film 0.5 watt

Trimpots

P1	100k horizontal, 10 x 5mm
P2	5k horizontal, 10 x 5mm

Capacitors

C1,12	10uF 50V bi-polar electro
C2,3,6,7	10nF 63V polystyrene 1% (Farnell 106-073 or similar)
C4,5,8,9	1nF 63V polystyrene 1% (Farnell 106-067 or DSE R-2780)
C10,11	330nF MKT 100V 5%
C13	0.1uF MKT 100V 5%
C14	4.7uF 50V bi-polar electro
C20,21	470uF 25V RB electro
C22,23	0.1uF MKT 100V 5%
C24,25	47uF 35V RB electro
C26,27	47uF 35V RB electro

Hardware

Case	Jaycar HB-5982 or as preferred
PCB	147 x 113mm, code 97afs08
Shield	150 x 120mm aluminium or unetched PCB material
S1	SPDT miniature toggle switch
T1	30V CT at 150mA; Jaycar MM-2007 or similar

Four 14-pin, two 8-pin IC sockets, 'dual wipe'; IEC panel mount mains plug; two stereo plastic 6.5mm audio jacks or XLR 3-pin male and female connectors; 200mm x 10-way multi-colour ribbon cable; four 3x20mm bolts, four 3.5x12mm bolts; eight 3mm nuts, four 3.5mm nuts, with star washers for each.

Note: The AD633JN ICs can be obtained from Analog Devices agent Insight Electronics Pty Ltd in NSW, for $7.95 each plus tax. Unfortunately a $50.00 minimum purchase applies to all sales. It is hoped that the major component retailers will put some of these components into stock.

an underdamped needle. Budget priced VU's should be the most suitable.

To align the AFS use an input frequency of 380Hz and a level of between 1 - 3V RMS. Adjust P1 and then P2 for minimum modulation, then repeat the above until no further improvement is possible; the modulation should now have all but disappeared.

If the input frequency is now swept up and down the audio band, there should be several areas where the modulation reappears and others where it disappears again (see note 3). The modulation percentage should not exceed 2% anywhere in the audio range, provided that sufficiently accurate components have been used in the outphaser. This small level of amplitude modulation at 10Hz has proved to be completely inaudible.

The Audio Frequency Shifter PCB module is now ready to install in your case. If you are using a plastic box then cut a piece of light gauge aluminium sheet or copper clad PCB material and place it under the AFS board with suitable spacers, connecting it to signal ground. Also connect the transformer's frame to mains ground by linking the IEC socket ground pin to the rear mounting panel (see photos).

If you opt for a rack-style case, then I recommend earthing the metalwork but leaving the PCB ground floating. Ceramic capacitors of 10nF or larger may be connected from input ground to the metal panel adjacent to the input connector, as an anti-RF interference measure.

DESIGN NOTES

1. The centre frequency (90 degrees shift) of the all-pass filters is given by the following formula:

$fo = 1/(2.\pi.R.C)$

2. The phase shift (*m* degrees) at any frequency (f) is given by a slightly more complex formula:

$m = 180 - 2.\tan^{-1}(f/fo)$

3. The calculated spot frequencies where the outphaser should have an exactly 90-degree phase difference are:

22.7, 49.5, 133, 380, 1053, 3010, 8036 and 17,615Hz.

Using the AFS

The AFS is designed to operate at standard line level of about 1V RMS. Connect in the signal chain before the main amplifier stage. If a graphic equaliser is in use, it may be connected either before or after the AFS.

When everything is set up I suggest you adjust the system as usual with the AFS in bypass mode. Then switch it into circuit and increase the gain setting until a slight warbling sound starts. Adjust the gain downwards about 2dB below this level and leave it. The PA system should now be both louder and much more stable than before, with no ringing and better intelligiblity.

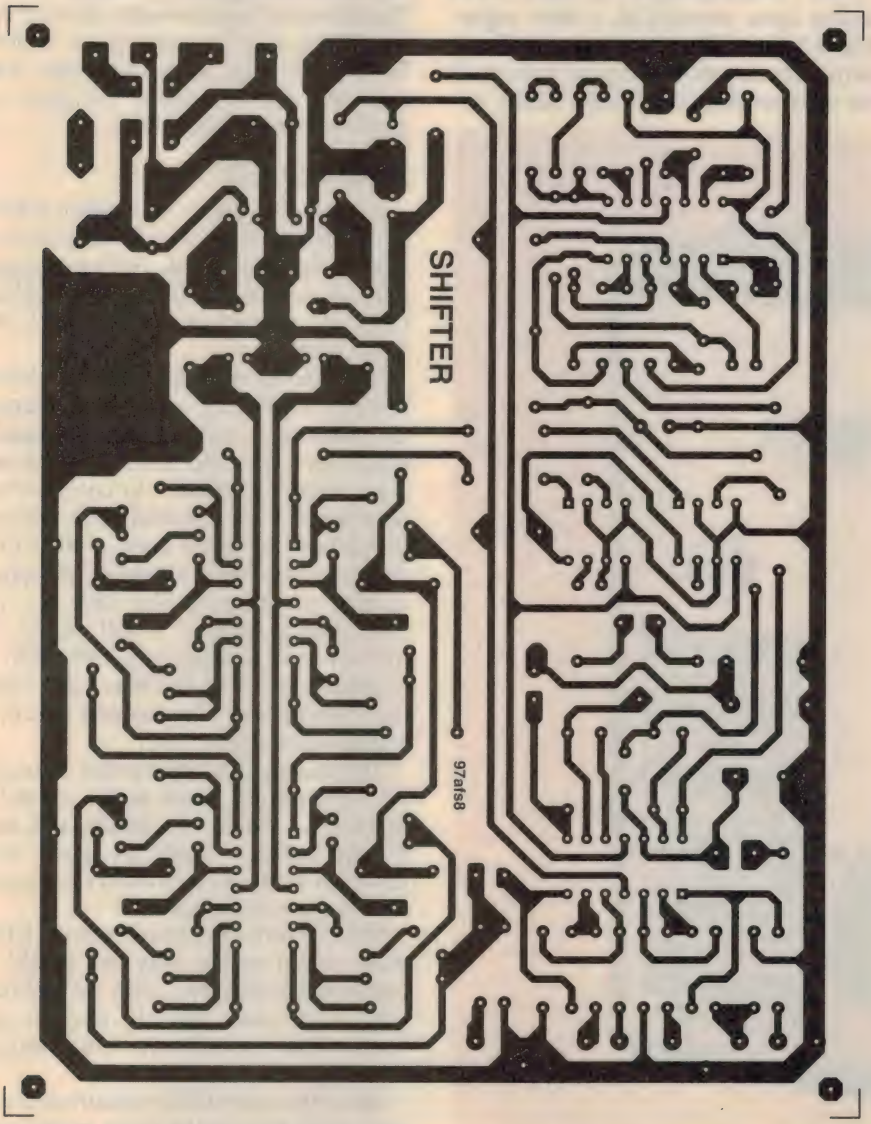
BEWARE, however: switching the unit back to bypass mode now will probably result in an immediate loud howling from the speakers!

Possible modifications

1. If desired the input gain may be altered to suit particular applications where the signal level may be higher or lower than the 1V level specified. The ratio R1:R3 and R2:R4 sets the input gain and R57:R59 the output gain. The overload margin and noise levels will be affected and a suitable 'trade off' should be found.
2. In the case of very large auditoriums the optimum frequency shift is less than 5Hz. To lower the oscillator frequency, increase the values of R44 and R45 by the same amount and also increase the combination of P1 and R54 by that same percentage. A frequency shift of 2Hz will suit even the largest venues.
3. A multi-channel unit may be constructed by installing the required number of PCBs and mains transformer with a higher rating. Allow 150mA AC of secondary rating for each channel.

References

1. Orchard, H.J., 'Synthesis of Wideband Two-Phase Networks', in *Wireless Engineer*, Vol 27, p.72 (March 1950).
2. Schroeder, M.R., 'Improvement of Acoustic-Feedback Stability by Frequency Shifting', in *Journal of the Acoustic Society of America*, Vol 36, No 9, p.1718 (1964). ❖



Here's the etching pattern for the shifter PCB, as usual reproduced actual size for those who etch their own.

Mini construction project:

THE MINISTROBE: USING THE NEW WHITE LED

Late last year Nichia Chemical Industries Ltd announced the release of a new semiconductor device, the white LED. Dick Smith Electronics has recently started to stock white LEDs, and so we thought we'd base this project around one of these interesting devices.

by GRAHAM CATTLEY

Not that long ago, LEDs came in four standard colours: red, green, yellow and orange. Blue LEDs have recently appeared on the scene, and these have raised a lot of interest in people wanting to make *white* LEDs.

By combining red, green and blue LED chips inside the one package, a 'white' LED could be created. You can find these LEDs around, but they do tend to draw more current, and require a careful balance in the current to each of the LED chips to produce a white light.

New developments in blue LED design have resulted in a new super-bright blue LED, by using a gallium-nitride semiconductor crystal instead of the usual crystal used in blue LEDs, silicon-carbide. This bright blue LED has opened up a new way to produce white light from a LED, by covering the LED's emissive surface with an yttrium-aluminium-garnet phosphor layer. The phosphor layer absorbs most of the blue light, and re-emits it as yellow light. This light mixes with the blue light that passes through the layer to produce a bright white light.

A white LED

So what are these new white LEDs like? Well, Dick Smith Electronics kindly sent us a sample LED to try out. DSE is currently selling the 5mm white LED as catalog number Z-4002 for $7.95 each.

From the outside, the LED looks just like any other LED, with a 5mm diameter water-clear body and 20mm leads. On closer inspection, however, there are some subtle differences in construction between this and a normal LED. Firstly, if you look down the body of the LED, you can see the yellowish phosphor coating covering the blue LED crystal. This coating appears a dull yellow in low levels of normal light, and when it is bombarded with the blue light from the crystal it will fluoresce and give of a bright yellow light.

The second difference is that there are *two* connections made to the crystal's surface — one for the anode, and one for the cathode. These are made with thin gold wire, and join the crystal's surface to each of the leads.

This is different from normal LED construction where only the anode is connected in this way, with the cathode connection made directly through the bond of the crystal to the 'cup' formed at the top of the cathode lead.

All of the white LED's electrical characteristics are printed in an eight-page data sheet supplied by DSE with the LED, but some of the more important

specs are listed in Table 1.

Needles to say, as soon as we received the LED from Dick Smith, we connected it up to a power supply via a suitable dropper resistor, and turned it on. Sure enough, the LED emitted a bright white light with perhaps a slight bluish tinge.

Running at 20mA, the LED produces 600mCd (quite bright) and a forward voltage drop of 3.2 - 4V. Table 2 shows the appropriate value dropper resistor to use for a number of different supply voltages.

The MiniStrobe

Well, a white LED is all very well, but what use can it be put to? After a bit of thought, we came up with the MiniStrobe. It takes advantage of the LED's bright white light, its high efficiency and fast response time.

As described, the MiniStrobe can effectively 'stop the motion' of almost anything running from 400 to 4000rpm. Electric motors, car engines, electric mixers, almost anything that moves or rotates at these sorts of speeds (or multiples thereof) can be seen as though they are stock still, by simply adjusting the knob on the front panel.

A Wide/Narrow switch lets you alter the width of the output pulse to prevent blurring at higher speeds.

The circuit

The purpose of this circuit (Fig.1) is simple: flash a LED at a variable rate, set by the speed control on the front panel. Essentially it's fairly straightforward, but by looking through the specs a way of achieving a higher output light level can be found.

Although the LED is rated at a maximum forward current of 30mA, it can be run at up to 100mA (and give correspondingly higher light output) if we follow a few simple rules: the LED must not run at this current for more than 10ms, and it must be left off for at least 90ms afterwards to cool down.

As you can see, this gives a 1:10 mark space ratio, with an upper pulse frequency of 100Hz. Now this doesn't sound much when compared with 4000rpm, but if you think about it 4000rpm translates to 66.66Hz — so our 100Hz maximum will let us view machinery running at a theoretical maximum of 6000rpm, more that enough to use on most domestic equipment.

The circuit is based around two 555 timer ICs, one set to provide a fixed length pulse to the LED when triggered, and the other to trigger it at a variable rate set by the user. U1 performs this second function, as it is set up in astable mode and delivers a needle-thin (30us) pulse on its output pin 3 at anything from 6.66Hz to 66.66Hz, depending on the setting of VR1.

R1 is a stopper resistor that limits the top speed of the astable so that we don't exceed our 1:10 mark/space ratio. These output pulses trigger U2, a monostable that is configured to produce one of two different pulse widths. With SW2 open, C3 charges through a total of 110k, giving an output pulse width of 1.8ms. If SW2 is closed, C3 charges through only 10k, and a much shorter 156us pulse is produced.

The pulse output from U2 switches on Q1, which in turn drives the LED via R5 a 56-ohm dropper resistor. This limits the current through the LED to around 100mA and provides a nice bright display.

Table 1: White LED Specs

Forward voltage:	3.6 - 4.0V
Max forward current:	30mA
Peak forward current:	100mA (1:10 mark/space)
Max reverse voltage:	5V
Max reverse current:	50uA
Max power dissipation:	120mW
Luminous intensity:	600mCd
Colour temperature:	8000K
Viewing angle:	+/- 30°

Table 2: Dropping Resistor Values

5V	68Ω
6V	120Ω
9V	270Ω
12V	430Ω
15V	570Ω
18V	720Ω
24V	1k (1 watt)

Construction

The MiniStrobe is built on a 26 x 60mm PC board, and is designed to fit inside the smallest of jiffy boxes along with a 9V battery.

Start construction by mounting the eight PC pins around the edge of the board. The four resistors and three

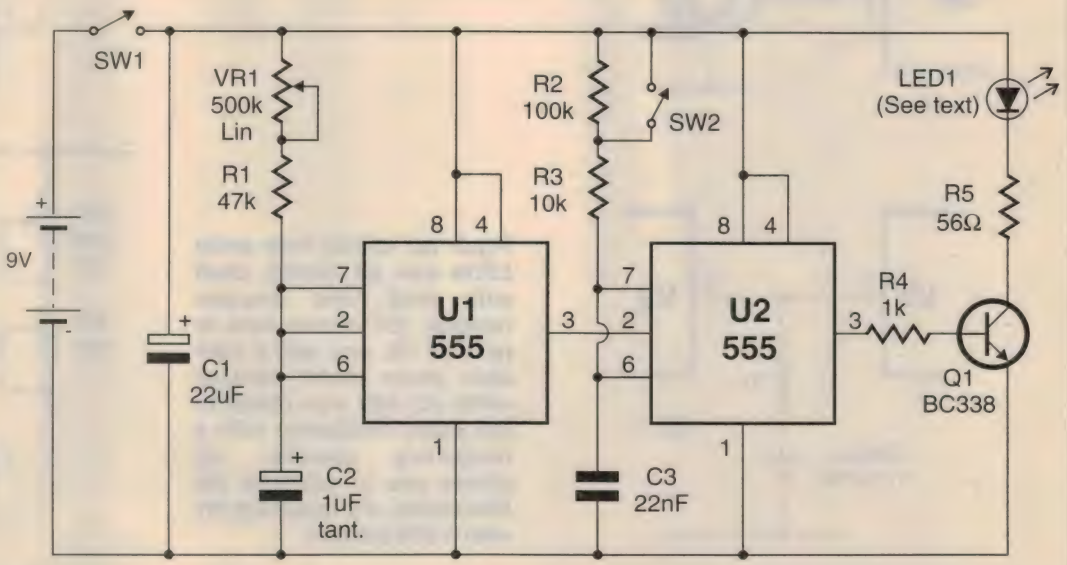
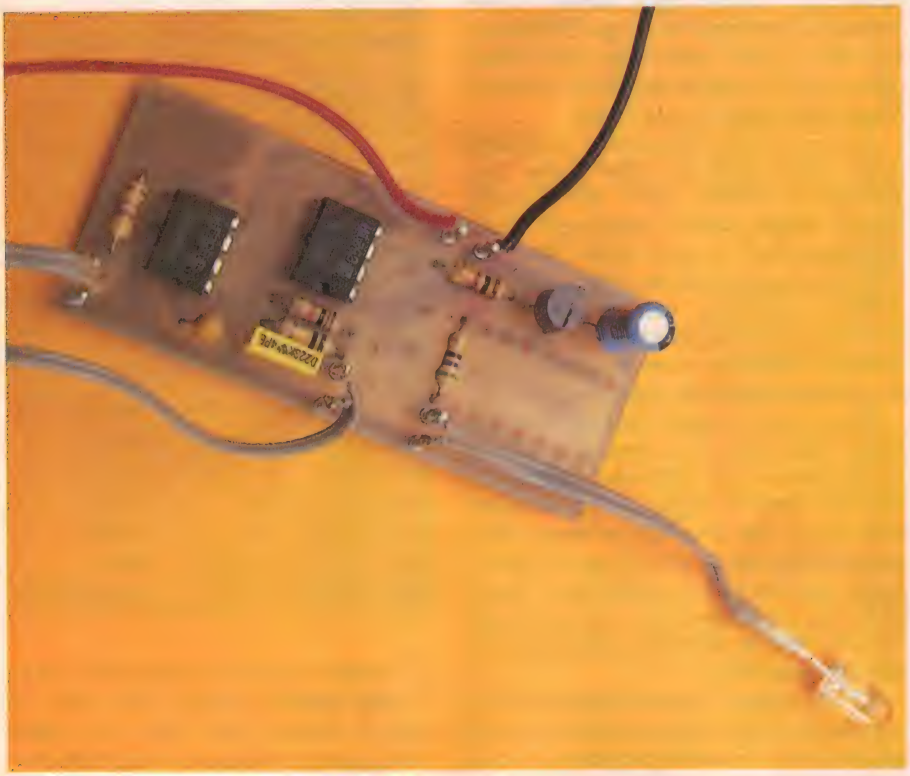


Fig.1: U1 runs in astable mode, generating narrow pulses at a rate determinated by VR1. U2 is a monostable that produces a 1.8ms or 156us pulse (depending on the position of SW2), every time it is triggered by U1. The output is buffered by Q1 which can handle loads up to 800mA.

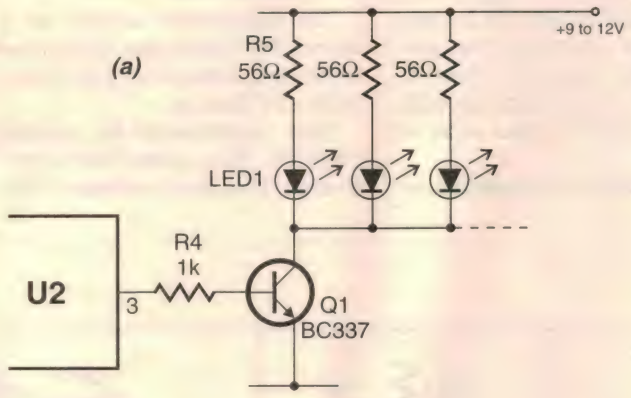


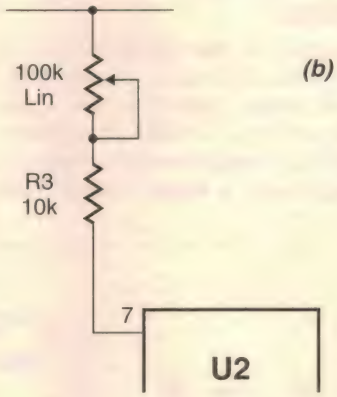
As you can see, there are a lot of unused holes in the basic circuit; these are used if you want to add some of the modifications shown below.

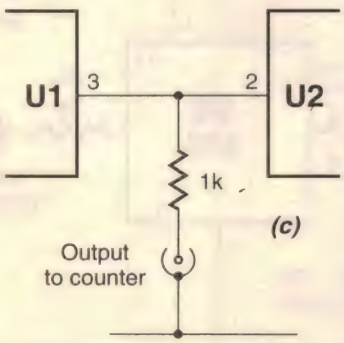
capacitors are next, followed by Q1 and the two ICs. Use the overlay diagram as a guide when installing these components, as you'll notice that a lot of holes are unused (for now) and it is easy to put a component in the wrong place.

Connect VR1 and SW2 to their respective PC pins using short lengths of hook-up wire, and then solder in a 9V battery clip with SW1 connected in series with the positive lead. LED1 should be connected to a pair of 50mm leads, keeping the actual LED leads long (around 10mm) and fitting a couple of pieces of heat shrink over the joints to prevent them from shorting together. (A handy rule of thumb when installing LEDs is to remember that when looking into the LED, the cathode leg is larger than the anode.)

Drill a 5mm hole in one end of the jiffy box to accommodate the LED, and three holes in the lid for the pot and two switch-







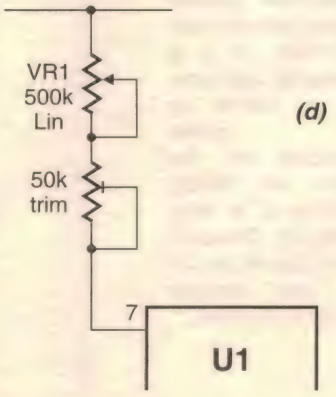


Fig.2: (a) shows how extra LEDs can be added, each with their own dropper resistor. (b) shows how to remove R2, and add a variable pulse width control, while (c) lets you measure the pulse frequency with a frequency counter. (d) allows you to calibrate the Ministrobe, by replacing R1 with a 50k trimpot.

es. Trim the pot shaft to 10mm or so and then you can put the whole thing together. The battery sits on edge on the right-hand side of the box, while the PC board can be held in place on the left with a small piece of foam packing material.

Optional mods

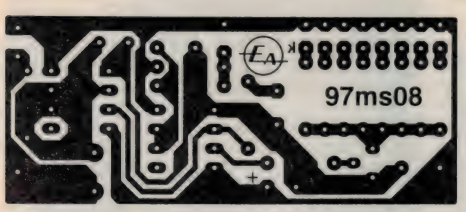
As mentioned earlier, there are some unused holes on the PC board, and these allow you to expand the MiniStrobe (MaxiStrobe?) in a number of different ways. The first (and most dramatic) modification is to add extra LEDs to provide more light output from the strobe.

There is provision on the board for an extra seven LEDs (and associated dropper resistors). These can, of course be more white LEDs if you wish, but you could also take the less expensive approach and install some of the cheaper high intensity red LEDs. These LEDs can produce up to 3000mCd, and can create quite an impact, particularly in a darkened room.

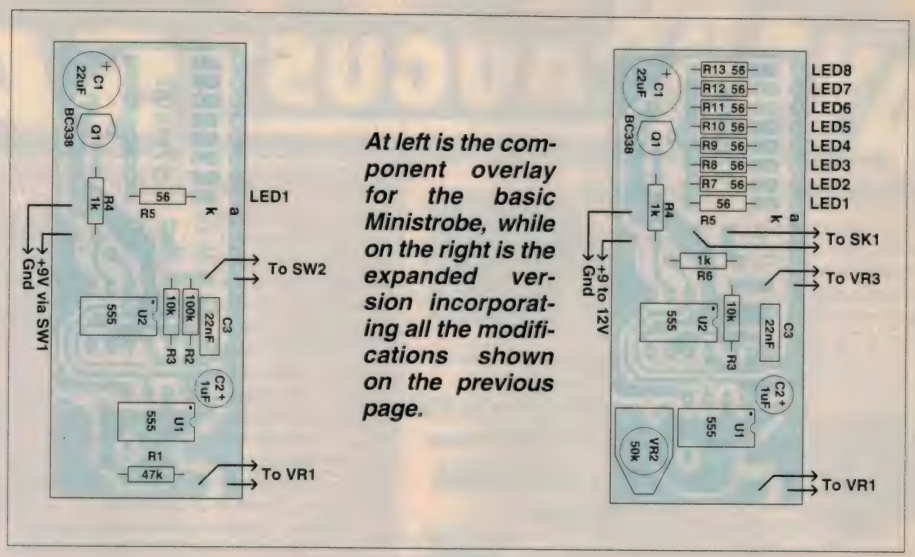
If you decide to add some extra LEDs, the MiniStrobe will probably have to be run off a 9 - 12V power supply, as the poor old 9 volt battery probably won't be able to keep up with the extra load. Fig.2a shows how the extra LEDs are wired in.

The second optional modification is to replace SW2 with a 100k potentiometer, to give a variable pulse width. In the original configuration of Fig.1, R2 is switched in and out of the circuit to give two different pulse widths. By removing R2 and replacing SW2 with a 100k pot (as shown in Fig.2b), a variable width pulse (at the same frequency) can be achieved.

Fig.2c shows how to add a BNC output to the MiniStrobe to enable you to accurately determine the rotational speed of an object, by letting you adjust the MiniStrobe to give you a stable view, and then connect it to a frequency counter to get an accurate reading. To convert the counter's output (in hertz) to rpm, simply multiply the reading by 60.



Above is the full sized PCB artwork, and at right in the front panel, again shown actual size.



At left is the component overlay for the basic Ministrobe, while on the right is the expanded version incorporating all the modifications shown on the previous page.

PARTS LIST

Resistors

(All 1/4W, 5% unless specified)

R1	47k
R2	100k
R3	10k
R4	1k
R5	56 ohms
VR1	500k linear potentiometer

Capacitors

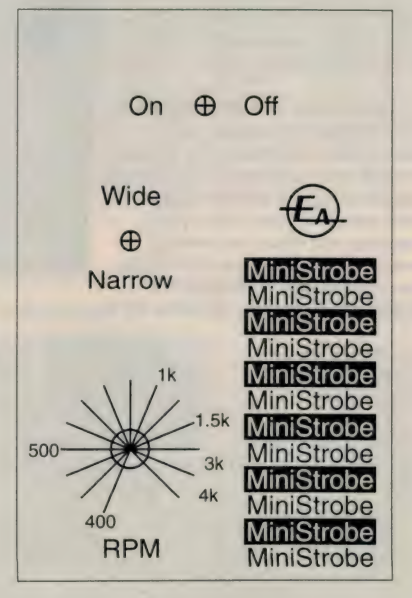
C1	22uF electrolytic 16VW
C2	1uF tantalum 16VW
C3	22nF MKT or polyester

Semiconductors

U1,2	555 timer IC
Q1	BC338 NPN transistor
LED1	5mm white LED (See text)

Miscellaneous

PCB 60 x 25mm coded 97ms08; small Zippy box 55 x 85 x 27mm; 2 x SPDT mini toggle switches; 8 x PCB pins; 9V battery snap, 13mm knob; hook-up wire, solder, etc.



If you want to calibrate the MiniStrobe, Fig.2d shows how a 50k mini trim pot can be installed instead of R1 to allow you to set the top end of the range. If you install the project in a bigger box, you can then use a larger knob on VR1 and mark off a new scale to match. The strobe's frequency drifts slightly with supply voltage, so in this case you would be best off running the unit off a regulated power supply.

Safety warning

One final note: The human mind tends to base its perception of the outside world on what it sees, rather that what it knows or hears. As a result, it is *very* easy to forget that a piece of high speed machinery is running when you are looking at it under a strobe — after all, it *looks* still...

DON'T be tempted to reach out and touch any part of a moving object viewed under these conditions, as you can cause serious injury to yourself and others. When testing this project with a 24V electric motor running at 5000rpm I still reached over to touch the small paper flag that I'd attached to the motor's shaft, to be met with an embarrassingly loud (and painful) buzz. So be warned! ❖

New blue LED

As well as the new white LED, Dick Smith Electronics are now supplying a new high-intensity blue LED that uses the new gallium-nitride (GaN) semiconductor crystal which produces a very bright blue light output when energised. The LED is encased in a water-clear resin, and has a viewing angle of +/-30 . The LED has a luminous intensity of 500mCd when running at 3.6V at 30mA. Dick Smith stores and dealers are stocking the blue LED as catalog number Z-4007, for $6.95.

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JAYCAR AUGUST SALE

Prices valid until 31st August 1997

CCD MINI CAMERA

This mini camera comes in a black metal case that measures only 35(W) x 35(H) x 15(D)mm!! Unbelievably small. Supplied with mounting bracket and lead with DC socket and BNC socket. Requires 12VDC, and connects to any standard video input - like your VCR, or via an RF modulator to a TV aerial.

NEW

Cat. QC-3470 **Only $159.50**

CCD BOARD CAMERA

NEW

Cat. QC-3460 **$139.50**

LOOKS LIKE A PIR CAMERA!

Includes infra red LEDs for night illumination.

Cat. QC-3450 **$169.50**

SCARY MAGNETS

NEW

These magnets are so powerful, they are scary! We purchased a moderate quantity of 25mm dia. x 12mZm high NEODYMIUM-IRON-BORON "ferrite" magnets. Little did we know just how unbelievably powerful they are! You simply cannot pull these apart, no matter how strong you are! Indeed, they come together so violently that your fingers would be injured if they got between them! They are so powerful we supply the set (of 2) separated by - would you believe - a massive 25mm inert spacer, and they still are strongly attracted to each other!! The power will simply blow you away and challenge your thinking about magnets.

Cat. TH-1875 We make no excuse for the price!

Set of 2 - $25 Pair

TDK RECORDABLE CD'S

Cat. XC-4710 NEW

$8.95 ea

10+ $7.95 ea

MOTOROLA MICROTAC LI-ION BATTERY

NEW

Lithium Ion batteries give you much better talk time and are environmentally friendly. This battery has a current capacity of 1.35 amp. When used with a 8400/8700 Motorola you get 120 hours standby & 540 mins talktime, and with a Microtac you get 40 hour standby and 180 mins talktime - and no memory effect. And at Jaycar pay no more. These sell for between $189 & $250 at our opposition.

Cat. SB-2572 **$139.50**

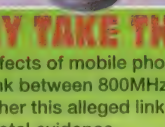
SAVE BIG BUCKS ON RESPONSE SUB / WOOFERS!

8Ω POLYCONE

Size	Power	Cat Pg	Model	Was $	Now $	Save $
6"	80WRMS	34	CW-2135	55.00	35.00	20.00
8"	120WRMS	35	CW-2136	69.50	45.00	24.50
10"	160WRMS	37	CW-2137	109.50	79.50	30.00
12"	200WRMS	38	CW-2138	149.50	109.50	40.00

8Ω CARBON FIBRE CONE

Size	Power	Cat Pg	Model	Was $	Now $	Save $
6"	80WRMS	34	CW-2140	79.50	49.50	30.00
8"	120WRMS	36	CW-2142	115.00	75.00	40.00
10"	160WRMS	37	CW-2143	169.50	109.50	60.00
12"	200WRMS	39	CW-2145	209.00	149.00	60.00



4Ω POLYCONE

Size	Power	Cat Pg	Model	Was $	Now $	Save $
6"	80WRMS	58	CS-2232	49.50	34.50	15.00
8"	120WRMS	58	CS-2234	65.00	45.00	20.00
10"	160WRMS	58	CS-2236	99.50	74.50	25.00
12"	200WRMS	59	CS-2238	135.00	95.00	40.00

4Ω CARBON FIBRE CONE

Size	Power	Cat Pg	Model	Was $	Now $	Save $
6"	80WRMS	58	CS-2240	69.50	49.50	20.00
10"	160WRMS	59	CS-2244	149.50	119.50	30.00
12"	200WRMS	59	CS-2246	185.00	145.00	40.00

CANCER FROM MOBILE PHONES - WHY TAKE THE RISK?

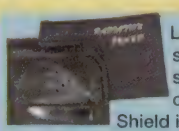
NEW

There has been much talk lately about the Electromagnetic radiation effects of mobile phones on your head. It seems that some university tests have established a link between 800MHz (mobile phone frequency) radiation and cancer in laboratory rats. Whether this alleged link is applicable to humans is yet to be established. Anecdotal evidence, however, seems to indicate that frequently used mobile phones give many people up to severe headaches, disorientation etc. Jaycar has been searching the world for over 6 months now to find a suitable RF (Faraday) shield to protect the head from radiation yet not compromise the performance of the phone itself.

At last we have come up with a product that does this. The area of greatest radiation concern is around the base of the antenna and around the earpiece ie. where your ear actually presses against the phone. Our product consists of a quality leather case custom made for most popular phones with a LEAD SHIELD sewn into the antenna base/loading coil area and right across the earpiece area. When you put the case over your phone you fashion the cloth protected extremely malleable lead shield around the antenna base. You can test the effectiveness with a meter type microwave oven leakage detector. The difference from unprotected to protected is amazing, yet the signal strength meter on your phone display will show the same levels of signal as an unprotected phone.

The Jaycar PHONE GUARD protector costs no more than a standard replacement leather case and gives you the comfort of reducing the direct radiation into your head which could be extremely harmful!

This superbly designed case also includes a ROTATABLE BELT CLIP, which easily allows you to turn your phone to the horizontal position, allowing you to sit down comfortably.



Lead shield shown opened. Shield is simply wrapped around the antenna base.

Microtac	Cat. HC-6920	Nokia 1610	Cat. HC-6932
Motorola 8200,8400	Cat. HC-6922	Nokia 8110	Cat. HC-6934
Motorola Flare	Cat. HC-6924	Ericsson 318/328	Cat. HC-6938
Motorola 8500,8700	Cat. HC-6926	Ericsson 738/788	Cat. HC-6940
Nokia 2110	Cat. HC-6930	**Only $39.95 each**	

NEW POWER SUPPLIES

Save $20 on each model.

12VDC 2AMP REGULATED

Cat. MP-3017 NEW

Was $69.95 **Now $49.95**

13.8VDC 2AMP UNREGULATED NEW

Cat. MP-3018

Was $59.95 **Now $39.95**

UHF/VHF FRINGE BARGAIN ANTENNA

NEW

The big brother to our best selling antenna. Its bigger and is ideal for using in fringe area locations. Receives UHF channels 28 to 36 (band 4) and VHF channels 0-11. This antenna is $50 less than the brand name equivalent. Boom length 2mts., 7 x VHF elements, 12 UHF elements and includes 75Ω balun to run coax. Please note that the big VHF elements are 1.3mts. long, so if you live in an area that very large birds frequent, beware! Cat. LT-3142

AMAZING PRICE! Only $79.95

NEW QLD STORE - ASPLEY 1322 Gympie Rd, Cnr Albany Creer Rd. **OPENING MID AUGUST**

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MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

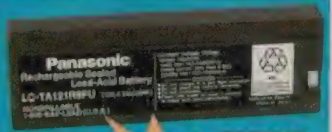
EXTREMELY LARGE LCD DIGITAL CLOCK WITH CALENDAR AND TEMPERATURE

This must be the largest LCD clock we have ever seen! Ideal for warehouses, factories, offices and home etc. Includes: •temperature readout in C or F •calendar with day, date and month display •12 or 24 hour time •huge 152 x 94 LCD display with actual time digits 55mm high •total size 210(w) x 230(h) x 25(d)mm. Charcoal in colour.

NEW

Operates from 2 x AA batteries. Cat. XC-0230 **Only $79.95**

PANASONIC 1.9AH 12V SEALED LEAD ACID BATTERY

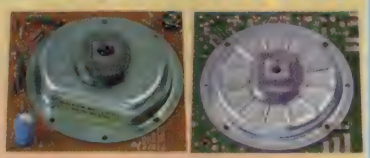


PANASONIC No. LC-TA121R9PU. Another surplus stock purchase. These are used in certain phones, or can be used as a standard SLA battery for burglar alarms, lights etc. Its very easy to solder leads to the battery terminals. Size 181(L) x 23(W) x 60(H)mm. To buy one of these as a replacement, it would cost arround $100. Cat. SB-2482

SAVE A FORTUNE! NEW

Limited quantity These are Only $20 ea

PINING FOR VINYL?



Now is your chance to make the ultimate phono turntable. Yet another scoop purchase. Yes Jaycar has done it again with a distress-stock purchase of a German PAPST toroidal brushless electronic turntable motor. This motor could be the basis for the ultimate home built belt-drive turntable! It can be driven by either AC or DC (16-32V) and is switchable 331/3 or 45RPM. Once speed is adjusted with 2 x10k potentiometers (not supplied) the power source can change by +/-30 odd percent with an almost unmeasureable change in motor speed! The secret is the built-in electronic control circuitry!! These motors were used by a couple of local turntable manufacturers who were into really up market products! Unfortunately they didn't survive the CD onslaught. Their loss your gain! Now that vinyl is back in vogue the price of high quality turntables etc. has skyrocketed! This motor was imported from Germany when the Aussie dollar was strong. They still cost over $A150 each in 200+ quantities! They sold here to OEMs for between $200 S $300. You will not pay anything like this price however!! We only have a limited quantity of these and we are making them available to you at the incredible price of $49.95 each! Full technical specifications with each unit. Please note: In order to build your phono player you will need other items such as: drive belt, small pulley, turntable cabinet etc. None of these are available from us. We can only supply the most difficult component in the equation!!

NEW

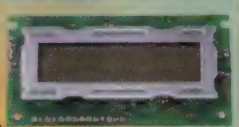
PAPST = GERMAN QUALITY Cat. YM-2700

$49.95 each (LIMIT 2 PER CUSTOMER)

Be early - quantities strictly limited.

SCOOP PURCHASE - 2 LINE 16 CHARACTER LCD DISPLAY

NEW



Not new - removed from poker machines to make way for more advanced technology. Guaranteed to work as a display but backlight will probably not work. If you want a backlit panel do not buy this unit. All decoder & drivers are on board. You can generate a full upper & lower case alphanumeric display as well as Japanese characters and symbols such as pi, sigma, omega etc. Note, we emphasize that the units are second hand & have been soldered to. They have been removed by professional technicians. 6 x 3mm (approx) character height. Overall display 28W x 72L x 4Hmm. **Cat. ZD-1890**

A Bargain At $9.95

12 VOLT 5MM HIGH BRIGHTNESS FLASHING LED

NEW

Ultrabright 300 mcd 5mm red LED, which is ideal for car alarm deterrent light. No dropping resistor needed. Specifications: •IV (mcd) at 9V - 300mcd •Power dissipation - 200mW •DC forward current - 38-56mA •Reverse voltage - 0.5V Cat. ZD-1785

$1.75ea.

RED HOT

POWER SUPPLY DEAL

AMAZING SURPLUS STOCK PURCHASE

1/2 PRICE

GME Electrophone 240V input 12VDC output at a huge 2.2 Amps. Unit is a desk top type, with 240V power lead (length 1.8mt.) and 12V lead (length 1.8mt.) terminated to a 2.5mm DC plug centre positive. Size 130(L) x 90(W) x 65(H)mm. **Cat. MP-3040**

These normally sell for $69.95

Only $35 ea

BUY 10 LESS 10%

C & K SLIDER SWITCH

NEW

SPDT PC mount. C & K 1101. Size 12(L) x 6(W)mm. Cat. SS-0815

1-9 Only 75c

10 plus 60c ea

12VDC NICAD/NI-MH CHARGER

NEW

Plugs into your cigarette lighter. Charges 1-4pcs. AAA, AA, C, D and 1pc. 9V. See 97 Cat. page 77 for full details. Cat. MB-3507

Only $29.95

HALOGEN LIGHT SETS

20 WATT LARGE SIZE KIT

NEW

Includes •20W lamp - 51mm dia. •Downlight holder (white) •Mains t'former, power lead Cat. SL-2750 ***Save $6.90***

Normally $34.85 Kit Only $27.95

50 WATT LARGE SIZE KIT

Includes •50W lamp - 51mm dia. •Downlight holder (white) •Mains transformer, power lead Cat. SL-2752

Save $6.90 Normally $34.85

Kit Only $27.95

20 WATT SMALL SIZE KIT

NEW

Includes •20W lamp - 35mm dia •Downlight holder (white) •Mains transformer, power lead Cat. SL-2755

Save $6.90 Normally $34.85

Kit Only $27.95

CABLE TIE SPECIAL NEW

We've made a surplus stock deal of some Dennison brand 125mm (5") cable ties. They will hold a maximum bundle diameter of 32mm. Save heaps over normal prices! Pkt. of 100 x 100mm sell for $4.95 Cat. HP-1207

125mm Pkt.100 Only $2.95

RESPONSE SPLIT CAR SPEAKERS

They just keep on winning! In a recent test in Hot 4's, our 4" speakers beat Clarion, JBL, Sanyo, Pheonix Gold, Coustic and Kenwood. Quote from Hot 4"s "We honestly did'nt think you could get a pair of speakers this good for under $100 pair, and we recon they could probably take on speakers triple the price" All include adjustable angle tweeters.

4"	Cat. CS-2280	$49.50ea
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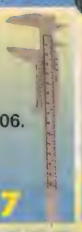

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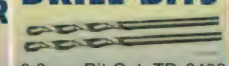

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See 1997 Cat. page 7 for details.

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REFER: Electronics Australia August, 1997.

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REFER: Electronics Australia August, 1997.

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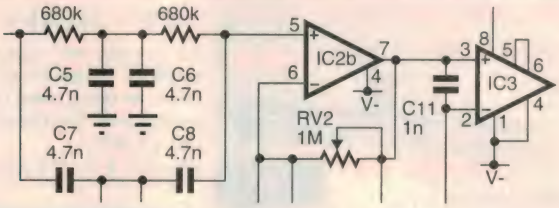
$10 Wonders

by OWEN BISHOP



5 - An exit door timer

Adding a simple security system to your home needn't be difficult or expensive, as this month's $10 Wonder shows. Using a couple of CMOS ICs, it's an alarm which can be coupled with last month's Programmable Alert to give a cheap and simple alarm system that can cover a single door or window, or even the whole house.

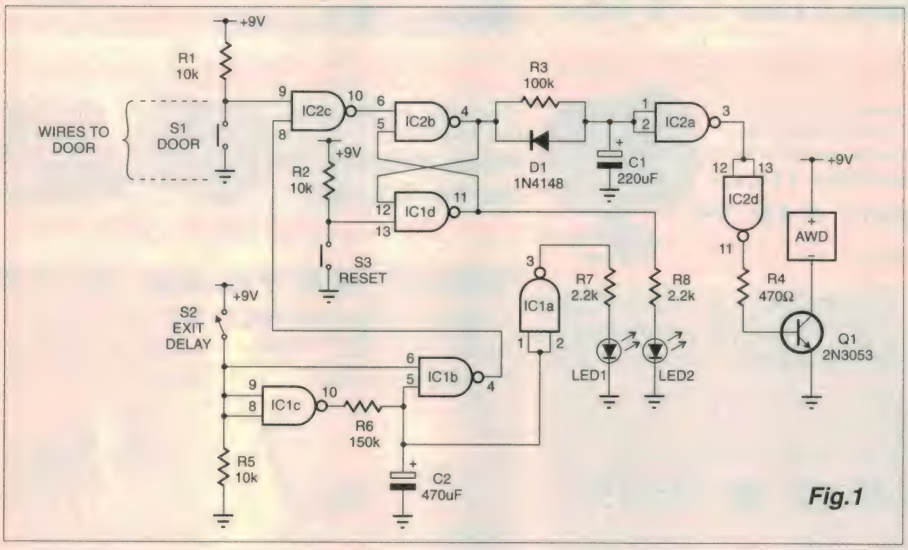


Fig.1

The weakest part of any security system is the Exit Door, the door by which you leave your home when you go out. Other doors, and windows too, may be securely bolted and chained from the inside, so that only brute force can open them. But you can't use bolts on the exit door — you have to rely on a lock.

Everyone knows that the latch-type lock can be opened from the outside using a piece of stiff plastic, and so it is essential for this door to have a mortise deadlock, preferably with five levers.

Keys can be copied, however, or you might forget to lock the door when you leave, so it is a good idea to have some kind of alarm system to back up the physical side of security. The problem then is how to get out of the house without setting off the alarm and, later, how to get back in again. The solution is this month's $10 Wonder project.

The circuit includes two timers, which allow you about 20 seconds to leave the house and shut the exit door behind you, without triggering the alarm. When you return, you again have 20 seconds in which to go to the hidden control box and reset the system. To keep the cost within our $10 budget, we use the relatively low-precision technique of timing by charging capacitors.

The sensor for this circuit is a switch mounted on the door. When the door is closed, this switch is closed, so we refer to it as a normally-closed (NC) switch. The simplest form is an inexpensive microswitch mounted on the door-frame, and arranged to that its plunger or lever is held depressed when the door is closed. Most microswitches have change-over contacts, so use the pair that are closed when the plunger is pressed.

The reason for using a normally-closed switch is that the system cannot be inactivated by someone cutting the wires between the door-switch and the control box. Cutting the wires has the same effect as opening the door!

Reed switch

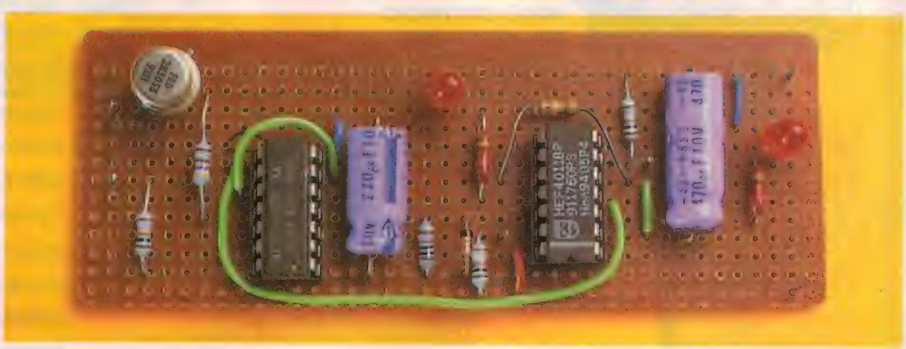
A neater but more expensive type of door switch is a magnetic reed switch. The switch consists of two lengths of springy metal ('reeds') sealed in a tube (Fig.2). This is mounted on the door-frame; some types suitable for a wooden frame are designed for fitting into a recess bored in the frame. The other part of the switch consists of a permanent magnet. This is mounted on, or recessed into the door.

When the door is closed the magnet comes close to the reed switch. Its field magnetises the reeds, causing them to be magnetically attracted to each other so that they make contact and close the switch. When the magnet is removed (door opened a few millimetres) they lose their magnetism and spring apart.

This circuit can be used with most of the audible warning devices (sirens, screamers, piezo-alarms) available ready made, provided they are rated to operate on 9V. Many operate over the range 6V-15V and so are entirely suitable. You may also use this circuit to drive last month's $10 Wonder, the Programmable Alert.

How it works

The part of the circuit labelled 'wires



to door' in Fig.1 consists of a pair of wires (light duty figure-8 wire is suitable) running from the control box to the door switch. At the control box, one wire is connected to R1, the other to the 0V rail. Incidentally, if you have several doors to protect, you could have a loop connecting their door switches in series. Then if any one of these is opened, the alarm is triggered.

The loop could also include devices such as passive infra-red detectors and smoke alarms, for many of these have normally closed switches which can be wired into the system.

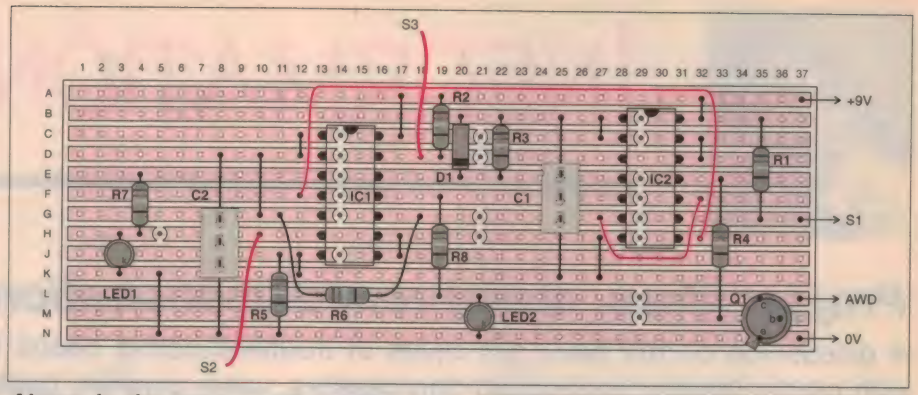
All the logic gates used in this circuit are of the NAND type — that is, their output is low (0V) only when both their inputs are high (9V); otherwise the output is high. The input to pin 9 of the NAND gate (IC2c) is normally low and, as we shall see later, pin 8 is normally high, so its output is normally high.

The next pair of gates are connected as a set-reset bistable or flip-flop. When the bistable is in its usual reset state, the output at pin 4 (IC2b) is low and capacitor C1 is discharged. This rates as a low input to IC2a, which has a high output, causing IC2d to produce a low output. Q1 is therefore off and the audible warning device is silent.

When the door is opened, even for an instant, R1 pulls up the voltage at pin 9 (IC2c) causing a low pulse which sets the bistable. Pin 4 goes high and the capacitor starts to charge. After about 20 seconds the voltage across it rises above 4.5V, providing a high input to IC2a, a low input to IC2d, a high input to Q1 and turning on the warning device.

It can be turned off only by pressing S3 to reset the bistable, or by disconnecting the power supply. This sends a low pulse to the other gate of the bistable and resets it. The diode between IC2b and IC2a allows C1 to discharge quickly through IC2b once its output falls low. The state of the bistable is indicated by LED2, which is on when the gate is reset and off when it is set. When it is off it indicates that the bistable has been triggered (set), and that the alarm may be expected to sound within the next 20 seconds or so.

The remainder of the circuit provides the delay needed to allow you to leave the house. IC1c and IC1b form a pulse generator, which has a normally-high output from pin 4, fed to pin 8 of IC2c as already mentioned, enabling triggering when the door switch is opened. When you want to leave the house, you close S2 and leave it closed. The result of the rising input to the pulse generator is to produce a low pulse lasting about 40s. This disables gate IC2c



Above is the component overlay for the strip board, while the diagram at right shows how the contacts of a normally open reed switch close when the switch is placed in a strong magnetic field.

so that its output remains high whether or not the door is open or shut. The bistable cannot be set and the alarm can't sound. The alarm is enabled again at the end of the low pulse.

LED1 indicates the state of the charge on C2. Normally this is high (9V) and LED1 is out. When you close S2, the low pulse begins immediately and LED1 comes on later, when C2 has discharged to 4.5V. By this time, you should be out of the house because the low pulse is due to end any second.

The pulse generator takes 30 seconds or so to recover its state after S2 is opened. When you return to the house LED1 will be on, reminding you to open S2. Do not close it again until 20 seconds or more after LED1 has gone out.

Construction

To minimise the wiring we have made use of the copper tracks for several inter-gate and inter-IC connections. For this reason, several of the strips below and between the ICs are *not* cut. Note that the ICs are NOT mounted level with each other, and that you can use solder blobs to join some of the IC pins in pairs, saving on installing some of the links.

Ideally the circuit should be housed in a plastic box on which S2, S3 and the LEDs are mounted. When you check the circuit after completion, bear in mind that electrolytic capacitors often vary by as much as 50% from their nominal value. If you find that timing periods are too short or too long, replace the capacitor with another one of the same nominal value or use a larger or smaller resistor to compensate.

Locate the box some distance from the Exit Door, preferably hidden in a cupboard, so that an intruder can't find it and switch off the system. The box should be big enough to hold a battery

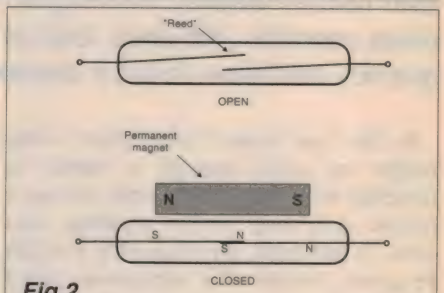


Fig.2

power supply. Quiescent power consumption is about 7.5mA, the main users of current being the LEDs.

We have used relatively large-value resistors in series with the LEDs to conserve current. If you feel that you can manage without their guidance, omit them and resistors R7 and R8, and the circuit could then be powered by a 9V PP3 battery.

For long periods of operation use a 9VDC plugpack, but keep the wiring hidden if possible. The 2N3053 transistor is rated at 700mA, which is more than enough for most types of buzzers, sirens and the like, but you could substitute a similar power transistor if you like. ❖

PARTS LIST

Resistors

(all 5% 1/2 Watt)

R1,R2,R5	10k
R3	100k
R4	470
R6	150k
R7,R8	2.2k

Capacitors

C1	220uF axial 16WV electrolytic
C2	470uF axial 16WV electrolytic

Semiconductors

D1	1N4148 signal diode
IC1,IC2	CMOS 4011 quad NAND gate
LED1,2	5mm red LEDs
Q1	2N3053 NPN transistor or equivalent

Miscellaneous

S1	Door switch (see text)
S2	Miniature slide switch, SPST
S3	Push-to-make pushbutton

Audible warning device, 9V operating (see text); 2.5mm matrix stripboard 98mm x 34mm (37 holes x 13 strips); 6 x 1mm terminal pins; 2 x 14-pin IC sockets.

INFORMATION CENTRE

by PETER PHILLIPS

Project ideas, classroom demonstrations and AmiPro

A discussion on the basic principles of troubleshooting opens the column this month, followed with reader letters covering wordprocessors, valve amplifier design and using a TV set as a computer monitor. We also look at passive infra-red security lights, shattering glass with a high frequency and how to tell if someone is passing through a gate located half a kilometre away.

In the June issue I was brave (some might say silly) enough to admit to jumping to wrong conclusions during a recent appliance troubleshooting session. In hindsight, by telling all, I might be giving readers the impression that I have little or no experience at faultfinding. When coupled with other admissions I occasionally make, some of you might wonder whether I have any technical expertise at all!

I like to admit to my mistakes, as I believe most people prefer this, rather than reading a pompous rundown on how good one is. It's much more interesting to read about failures, as, if for no other reason, it makes you feel better about your own limitations. But it does tend to give an impression that perhaps Peter Phillips is a technical idiot.

I'm prompted to say this because of our first letter, which although perfectly reasonable, is perhaps based on the writer's impression of my skills (or lack of them). Here's the letter, followed of course by my defence.

TV servicing

I read your preamble on Page 88 of EA, June 1997 and was surprised at the method you decided on to locate the problem in your CTV (colour television set).

Why you decided that the horizontal line output stage was faulty, without any preliminary checks of the bridge rectifier, regulator, or over-voltage/current section, or deflection yoke is beyond me. Removing the line output transistor without substituting a load (i.e., 60W or 100W/240V bulb) across the collector to emitter is ludicrous and is asking for a power supply fault at the very least!

Why remove the vertical section of the CTV? I have never repaired a CTV yet that had the vertical oscillator or its output as the cause of blowing a fuse.

Which 'textbook' did you consult before undertaking this repair? Your "In all cases I had taken a textbook approach to troubleshooting..." is thoroughly inaccurate in the case of CTV repairs! Consultation with EA's own serviceman (a qualified CTV technician) before describing this method of troubleshooting might save a customer a lot of money and the technician a lot of work trying to figure out why a TV is dead after one of your readers attempt your 'rip it out and turn it on' method, in the belief it's the accepted norm in the trade! (Tony Jones, A.T.E.T.I.A, Tasmanian Division, by email.)

When describing my faultfinding method Tony, I purposely kept it brief. I wanted merely to point out the actual problem, not really how I found it. I was trying to show readers that sometimes a fault is not really a fault, but an error, in this case on my behalf by not remembering such a basic thing as the type of fuse I should be using.

I gather from your letter that you think I should be consulting with experts. While it's been some years since I did a lot of TV servicing, it's quite possible I have taught some of your colleagues. I taught TV servicing for over five years in NSW TAFE, before moving into a different part of the TAFE system where I taught computers, microprocessors and so on. Prior to teaching, I ran my own TV servicing business.

As you might remember, a TV servicing course takes 18 months to two years, and covers every part of a TV set in detail. The theory is augmented by practical sessions that usually require students to find faults in the part of the receiver covered in the associated theory session. The teacher therefore has to know what he's talking about, as students will quickly complain if the teacher is incompetent.

In the field, things are very different compared to a TAFE laboratory. There's rarely time to theorise, and most technicians use methods gleaned from experience. I remember a part-time TV teacher (technician in the day, teacher at night) showing students how a knock with a screwdriver can help find an intermittent fault. A useful technique, but outside the syllabus.

So let's look at the Peter Phillips' method of finding faults, which is based on a lot of teaching and practical experience. (And perhaps a few more readers will remember me teaching a faultfinding course in industry as a private consultant.) I know, bragging again — but perhaps it's time to point out a few aspects of my very varied background.

The first thing is to locate the area of the fault by regarding the appliance as a system. There are four types of systems: linear, divergent, convergent and feedback. Most appliances are a combination of all four, so you really have systems within systems. A TV set is a very complex 'system', so it helps to locate the area first, then view that area as a system. And that is the method I used to faultfind the set I mentioned.

But there are other practical rules to follow as well. The first is one I learned in the field: do the easy things first, like check the fuse, connections etc. The usual sensory checks (sight, sound, smell etc) also come into it. Then there's the fault history of the particular appliance, and faults for that model. Most technicians have access to data that lists known faults for a particular model, now available on floppy disk or CD-ROM from some technical organisations.

Now let's look at the set in question; a Philips KS631. It's a very unusual set and it's likely I own the only one of its kind. It is a modified version of a European model and was used as the basis for the Australian version, which looks very similar on the outside. Inside, the set has a mother board and lots of plug-in modules. The local version has

everything on one board, and also differs in some parts of the circuit, particularly the power supply.

This is why is was easy for me to check if the vertical deflection board was faulty. All I had to do was unplug it. As for checking the power supply, of course I suspected it. However, in this set the power supply is relatively simple, and there were no indications of any sort to make it worth unsoldering diodes etc., to further check it. Furthermore, the horizontal output stage produces most of the supply voltages for the set.

You mention connecting a load across the collector and emitter of the LOP (line output) transistor. This technique might apply to more modern sets, but my set dates back to 1985 (or so). With the LOP transistor disconnected, there's no current through the LOP transformer and no voltages developed for the rest of the set.

And why did I reckon the LOP transistor or transformer might be the culprit? Given the circuit diagram, the history of the fault, visual checks etc., these components seemed the most likely. They both do the most amount of work in the receiver, and given the age of the set, and that it was a development model, it was a very reasonable assumption.

I could go on Tony, but I certainly followed a textbook approach in attempting to isolate the fault to a particular section. My methods of doing this were based on the set in question, and might not apply to all sets. I also followed the practical rules. And as you must admit, I also found the fault.

As for readers following my method, as you will know from your own experience, quite a lot of faults are owner induced. I remember a guy hiring me to readjust his brand new set after he had attempted to 'improve' it by fiddling with every available adjustment on the back panel. Another customer of mine tried to improve his set by adjusting the slugs in the tuner, the IF strip (an old set) and wherever he could find something that turned.

If a reader, or anyone for that matter is silly enough to think they can fix a TV set after reading a five-minute dissertation in a magazine, then they deserve to pay for the service call. But as I've said before in this column, I doubt that our readers think that reading *EA* is a substitute for formal training and practical experience. It never has been, and will never be so. We are a technical magazine and mainly for technical people. If we have to couch everything we write in the belief that someone might do something silly, we would be of no interest to our intended audience.

TV as a monitor

In May I included a letter from a reader seeking information about making a conventional TV set into a computer monitor. The following letter gives a Web address for further information on doing this:

Referring to Roger Duke's letter in May, if he has Internet access, there is a fair amount of information on converting a TV set into a computer monitor at **http://www.hut.fi/~then/electronics/pc_video.html.**

A subsection on this Web page on PC Video topics is titled 'Computer and TV' and has a number of links to suggestions and solutions to this problem, including software and circuits. The home page **http://www.hut.fi/~then/** *has a number of links which lead to all kinds of electronics and programming information.*

Thanks, EA, for helping me foster a general interest in technology since I was 10 years old. Keep up the good work. (Dominic Peterson, Queensland University of Technology.)

And thank you, Roger, both for you kind comments and for this information. The Web is certainly a useful source of information.

Valve amp design

And here's another response to an enquiry in May, this time about a book on designing valve power amplifiers.

Regarding valve power amplifier design, I recommend the book described below. I have found it gives an excellent coverage of the field as it is today, and is based on commonly available devices. The description is from the London Power Web site at: **http://www.wwdc.com/~power/index.html**.

The book is called Principles of Power, A Practical Guide to Tube Power Amplifier Design, by Kevin O'Connor, ISBN 0-9698-6081-1, 221 pages, spiral bound with 210 schematic diagrams. Price: $35 US, $40 CDN within Canada.

The book offers a simplified method for designing tube power amplifiers for audio use. The traditional graphic approaches have been synthesised into a few simple equations that allow the direct use of tabled tube data. Vacuum tube operation is clearly explained, as are class A, class B, cathode bias and fixed bias operation. Push-pull and single-ended designs are included, as are numerous front-end circuits. Differential, concertina, paraphase and transformer drivers and splitters are presented, with new light shed on a few 'long lost' methods. Specific circuit adjustments are offered for linearising audio amplifiers, and for maximising power output for musical instrument use.

The book includes complete designs that incorporate off-the-shelf transformers and currently available vacuum tubes. Designs include amplifiers with a power output from 15 watts to over 400 watts. Output transformerless designs are presented and up-to-date hybrid

tube/solid state circuits are explored. A complete design method is offered to accommodate any output power level. Also included are power supply designs, an appendix that covers tube data for commonly used types, a list of new ultra-wide-bandwidth audio output transformers from Plitron Mfg, as well as their matching power transformers. Appendix C provides information on the newly expanded line of Hammond transformers for tube use. (Bill Bolton, Sydney, NSW)

So valve amplifiers are no longer a thing of the past! Thanks Bill, for sending this information, it's bound to interest quite a few readers seeking the 'valve sound'.

Security light problem

The next letter seeks advice on disabling the permanent-on function included in most PIR operated security lights.

Can somebody help me with a Nitewatch Series NW-12 Sensorlite infrared passive security light? This light has a facility to switch it on permanently by switching the supply off and on within two seconds. All very well if you don't live in the country, where at the first lightning strike there's usually a short power interruption, causing the light to come on and stay on.

This is not too bad if you are at home, but if you happen to be away for some time, you are obliged to worry a neighbour to switch the mains off for more than two seconds.

I have not been able to get any information such as application notes on the IC used in the light so I can disable this facility. The numbering of the IC does not tie in with the generic system, so I assume it's a special IC. (Tony Paine, Springton, SA)

As you say Tony, this function is apparently achieved with an IC, and without the data, you have no way of knowing how to disable it. I assume you've tried the manufacturer or the agent for the light fitting. Or perhaps it's an imported item. I can't help you, but perhaps a reader has figured out a way to overcome this problem.

Word 6.0 problems

I had expected more letters in support of Word 6.0 after my introduction in the May column. But the only letter I've received about this is one agreeing with me:

In the May 97 edition of EA you mentioned problems with Word 6.0. Would your problems have anything to do with master documents? Or large documents in general? I have problems using Word with large documents (more than 10 pages), especially where more than one section is involved. I can never seem to get the sections to have the page numbering just the way I want. I would be interested to hear how AmiPro fares in this regard. Is there a review of AmiPro you could point me to? (Fabio Barone, Griffith, NSW)

The problems I've had with Word 6.0 are not necessarily to do with the size of the document, as the document in question ran to over 200 pages. Instead I think it's more to do with the rather clumsy way everything is done in this program. I have always disliked programs that try and do the thinking for you, as rarely does its solution suit your needs. For this reason, and because it takes too long to get a document together with Word, I prefer AmiPro.

I earn a large part of my living with AmiPro, and have used it to produce camera-ready copy for five textbooks and a large range of documents of all types. I've also used it for a range of two-colour documents, as a database linked to its mailmerge facility and so on.

When I did freelance software reviews for *Your Computer*, I reviewed version 3.0 of this program, sometime in 1991, I think in the March edition. The most recent version is 3.1, which fixes some of the bugs in version 3.0.

But perhaps you might be interested in a short history of this amazing program. I first saw it demonstrated at a press conference in the late 80's. At the time, all word processors for IBM compatibles were DOS-based, and importing graphics was difficult and cumbersome. So imagine my interest when for the first time on an IBM PC, I saw integrated text and graphics on the screen just as it would print out on paper.

The program includes a simple but versatile vector-based drawing program, rather like DrawPerfect. After seeing AmiPro in operation I immediately purchased a copy and used it to produce a number of simple books for sale to TAFE students. I later produced a range of illustrated documents for various clients at a time when these documents were otherwise put together using conventional 'cut and paste' techniques.

AmiPro was originally developed by the Samna Corporation, and was based on modules the company had developed for industrial clients, including the company's Ami wordprocessor. Lotus bought Samna in 1994 (or so) for $60 million and rewrote it to version 3.0 and subsequently 3.1. Lotus is now owned by IBM, and AmiPro is now WordPro, part of the Lotus Smartsuite. Unfortunately, although WordPro has more bells and whistles, it is slower and not as reliable as AmiPro.

Like all programs, AmiPro has the occasional bug, but although I've used it for nearly 10 years, I have never lost a document and have found version 3.1 pretty reliable, even under Windows '95. I believe I could not earn a similar income using Word 6.0, as although it has similar facilities, it takes nearly twice as long to put a document together. I have never understood why AmiPro is not the standard, as it's truly an industrial strength wordprocessor.

Shattering glass

The next letter comes from a reader interested in using a high frequency to shatter glass.

I'm writing to ask you or your readers advice on a topic that, to the best of my knowledge, has never been covered in EA. I am a retired science teacher, and I still enjoy entertaining little ones at primary schools with scientific tricks. A Van de Graff generator and its 'hair raising' effect is always a hit.

But I would like to include in my itinerary (with the older ones) a demonstration of shattering glass with a high frequency. I remember seeing this many years ago, but I forget how it was done. About ten years ago I tried using a 10W valve amplifier (an EA design), but all I succeeded in doing was burning out the output transformer.

Last year I built the EA 50W per channel stereo amplifier, so I wonder if I could use it with an appropriate tweeter. Is there a problem I'm not aware of to do this, or do I need more power? I was intending to use small thin-walled pill bottles, placed about 30cm from the tweeter. Or if these are not available, I thought of using 2mm sheet glass cut to a 10cm square. Is there a way of roughly calculating the resonance of such a sheet? I have no reference in any of my books. Thanks for a very interesting column each month. (L. Beswick, Newnham, Launceston)

Thanks for the kind comments, Mr Beswick. Readers might remember you

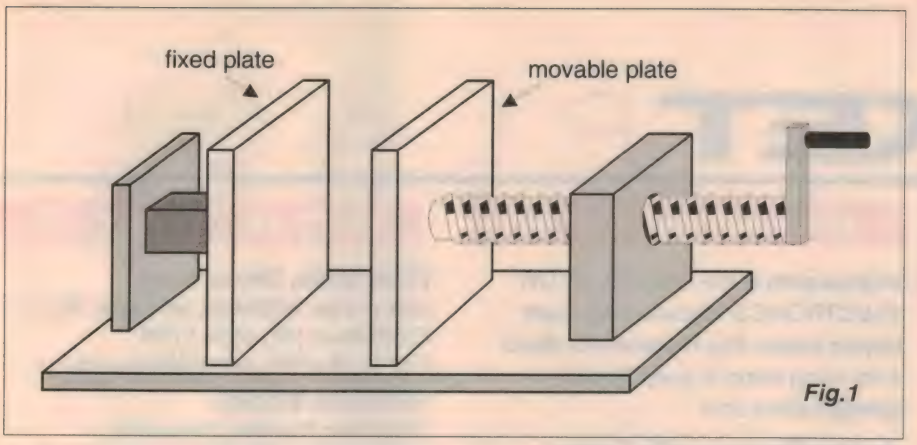


Fig.1

as the contributor of perhaps one of our most popular What?? questions, the star puzzle where all numbers add up to 26.

While I have no experience in what you want to achieve, I wonder if the resonant frequency of a small piece of glass is too high for an audio amplifier. Perhaps you need a larger sheet. I also suggest you use a piezo tweeter, as these are more efficient than a conventional speaker. An alarm siren might do, providing it can work with a range of frequencies. That is, it's not tuned to one frequency.

We've all heard of a soprano hitting a high C (around 1040Hz), and shattering a window. Whether this has ever actually happened I don't know, but I'm sure it's possible. Perhaps a reader who has done experiments in this area might let us know.

Remote gate alarm

The following letter describes a project idea that could interest anyone who wants to know if someone has passed through a gate. The problem is the gate is about half a kilometre away...

I live on a block of land on a main road in Queensland. I'm always worried about security, especially at night, as my neighbours live some 300 metres away. The front gate is about 500 metres from the house, and I have a shed full of equipment between the house and the gate. It's not practical to lock the gate at night and unlock it every morning, so I'd like to suggest a project that might overcome the problem.

My idea is to have a beam set across the gate, powered by a battery that is charged with a solar panel. When the beam is broken, a transmitter would send a signal to the house and sound a doorbell or an alarm. For security reasons, the beam must be invisible and the circuit boards small enough to put inside the gate posts (pipes). A movement detector is no good, as it would detect every passing wallaby and roo. (Martin Clark, Townsville, Qld)

We published a project in February 1994 that could help you Martin, and an updated version of this project is in the July 97 edition. The project is called a laser beam communicator, but it can double as a perimeter detector. The idea is to use an infrared laser beam across the gate. When the beam is broken, a relay operates.

The next thing you need is a solar battery charger, and one was described in the November and December 94 issues. Both of these projects come from Oatley Electronics, who can probably help you further. The final part is a transmitter that can send a signal over a distance of 500 metres. If you have line of sight between the gate and the house, the laser communicator can be used, both as a speech transmitter, or simply to send an on-off signal to the alarm in the house.

Otherwise you'll need a radio signal. Unfortunately most of the UHF systems we've described can only operate to a maximum of 100 metres. However, a commercial system for controlling a model aircraft might do. In any case, I suggest you contact Oatley Electronics on (02) 9584 3563 for further details. They might have something suitable.

75 years old

In case you haven't noticed, *EA* is now 75 years old, making it one of the oldest magazines in Australia. My association as a writer for *EA* goes back a mere 18 years, and with this column for almost nine years. I see it as a privilege to be not only the recipient of so many reader letters, but to be associated with one of the most venerable institutions of the electronics industry. So congratulations *EA*, and my thanks to all readers for your letters. It's you who make the magazine a viable proposition, and that's something that we, the writers, must never forget.

What??

Once again I need to appeal to you all for more What?? questions, because we're running low. You can email, fax, post or download to our BBS any question you think might appeal to other readers. We can only offer you the moment of fame you will get as being the presenter of the question, and of course my gratitude.

The question this month comes from John Raymond, and concerns a capacitor and lost energy. We've had similar questions before, but not quite like this one:

As shown in Fig.1, a specially made variable capacitor has an insulated fixed plate (left) and a movable grounded plate (right) which can be moved by turning the handle on the feed screw. Now:

1. With the plates well apart, we measure a capacitance of one farad (big plates!)
2. Charge the plates to 1000V and remove the charge source. Assume no leakage or series resistance, so the capacitor remains charged at 1000V. As charge = CV, the charge is 1F x 1kV = 1000 coulombs. The stored energy is $1/2CV^2$ = 0.5 x 1F x $1000V^2$ = 500,000 joules.
3. Turn the handle very slowly to bring the plates closer together, until the capacitance is two farads. The charge must be conserved at 1000 coulombs, so as C = 2F, V must now be 500V. But: the stored energy is $1/2CV^2$ = 0.5 x 2F x 500^2 = 250,000 joules.

So, where has the lost 250,000 joules of energy gone? It can't be lost in heat (we are assuming no resistance losses), and it can't be lost in EM radiation as we changed the capacitance slowly. It can't be lost by antenna radiation as the charge is DC. As well, energy can't be destroyed. Over to you!

Answer to July's What?

According to Professor Sumner Miller: Strangely enough — the density of the medium does not enter the discussion. In a sea of mercury, waves of a certain wavelength would travel with the same speed as sea-water waves. Isn't Nature fantastic! ❖

EA'S READER SERVICE BBS

As part of our service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS), which makes available a wide range of useful information for convenient access and rapid downloading. You can also leave contributions to some of our columns.
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READER INFO NO. 47

(Continued from page 51)

both signals will appear in the output at equal amplitude. However, what if we vary the duty cycle? If we do that, then we vary the balance. One input will be on more than the other in a given clock period. Remember that since we're sampling at 100kHz, we always get enough of the signal to reproduce it correctly.

In varying the balance, we can produce a cross-fade, allowing us to vary the mix from one channel only, through to a balanced mix through to the other channel only. And all using just one IC.

This is one case where if we'd used two transistors instead to create the oscillator, we would have used more current as well as making the whole design much bigger than it really needed to be.

There are no loading problems that often occur with simple resistive mixers, since only one input is ever connected to the circuit at any one time. They just swap over a lot — that's all!

The cross-fade function here is used in many situations and is a great way to spruce up your own home movies.

Well, that's all for this month. Next time, we'll continue with more circuits using this handy little IC. See you then. ❖

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READER INFO NO. 45

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READER INFO NO. 51

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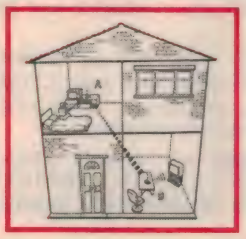

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READER INFO NO. 46

SHORTWAVE LISTENING

with Arthur Cushen, MBE

Voice of America's New Sao Tome Relay

The opening of a new Voice of America relay base on the island of Sao Tome created world wide interest for shortwave listeners, as for many this was a new country to be received and verified. Like many listeners, my reports on the reception of Sao Tome were sent to the Voice of America in Washington and when the first verification was received it made my total verified countries up to 301.

Recently a North American listener heard Sao Tome on medium wave on 1530kHz and this resulted in a very detailed account of this isolated broadcasting station in the Gulf of Guinea, off the coast of West Africa. Sao Tome is a small island of volcanic origin and measures about 30 miles from north to south and 20 miles in width. The VOA relay station is located just south of the town of Sao Tome on the main island. The medium wave antenna is a two tower array. The 1530kHz AM transmitter has a power of 600kW and is of Swiss manufacture.

The station operates seven transmitters. One on medium wave, four on shortwave of 100kW, a modified transmitter for use on the tropical band, and a further medium wave station on 945kHz which the VOA have provided. The latter has a power of 20kW and broadcasts locally-produced Portuguese programes for Radio Nacional De Sao Tome E Principe.

As well as the medium wave towers there are 14 curtain shortwave antennas to cover the shortwave bands as well as a special aerial for the tropical band frequency. The power for these seven transmitters is supplied by VOA's diesel generating plant, which produces close to 5MW (megawatts) — so the station uses more power than the rest of the island of Sao Tome.

As this is a relay station there are no programmes produced on Sao Tome; all programmes are received on a digital satellite link which originates from the VOA studios in Washington. The station's local address is: The Voice of America, Sao Tome Relay Station, PO Box 522, Sao Tome in Principe, West Africa. However listeners should direct their reports to the VOA's Washington address as the chance of a verification from Sao Tome is remote — there are no staff on the station prepared to issue verifications.

This information is only available because Chief Engineer Charles L. Lewis was supervising the transmitter plant recently and he took the time out to answer in detail a report from a listener in the United States.

All India expands

The history of broadcasting in India goes back to the early days when amateur type stations began to operate on medium wave in 1926. By 1936 these medium wave stations had been established in Calcutta, Bombay, Madras, Delhi, Lahore and Peshawar under the present name of 'All India Radio'. In this phase of Indian radio there was only restricted coverage, except at night when most stations covered a greater portion of the country; but there were difficulties in networking programmes and it was not until the event of shortwave broadcasting that a more suitable service was introduced.

The wartime influence of All India Radio was appreciated by the British Government and the BBC, which had difficulty in reaching India, began to use their transmitters on shortwave to cover the Asian area of Australia.

According to *DX Post* of India, the first cluster of India's high powered shortwave transmitters sprang up around New Delhi during the 1950s. Aligarh became the site of 250kW shortwave transmitters almost a quarter century ago. Later on Madras and Bombay received their 100kW shortwave transmitters to launch a nation wide commercial service named Vividh Bharti.

India also went hi-tech, making use of the indigenous satellites, when she installed her first super-powered shortwave transmitter outside the Delhi-Aligarh belt in Bangalore. Four 500kW shortwave transmitters were ordered in 1989, the first was delivered in 1989 and test transmissions began in November. The signal was directed towards West Asia, but according to reception reports received it was picked up loud and clear as far away as New York. The 500kW Bangalore based shortwave transmitter is currently India's best ambassador in Europe and North America.

The schedule for listeners in Australia and New Zealand in English is: 1000-1100UTC on 13,700kHz, 15,050 and 17,387kHz; and 2045-2230 on 7150kHz, 9910 and 11,715kHz. ❖

AROUND THE WORLD

CZECH REPUBLIC: Prague broadcasts to Australia and Asia 0900-0930 on 17,485kHz; to South Africa 2000-2027 on 11,600kHz and 2130-2157UTC on 9495kHz.

INDIA: AIR, Delhi's latest schedule shows: 1000-1100 on 15,050kHz, 13,700 and 17,387kHz; 2045-2230 on 7150kHz, 9910 and 11,715kHz.

IRELAND: West Coast Radio broadcasts on Thursday 1900-2000 on 15,625kHz and on Saturdays from 1500-1600 on 6175kHz.

ISRAEL: IBA broadcasts in English 0400-0415 on 7465kHz, 9435 and 17,545kHz; 1400-1430 on 12,080kHz and 15,650kHz; 1545-1600 on 12,080 and 15,650kHz; and 1900-1925 on 7465kHz, 9435, 11,605 and 15,640kHz.

KOREA: Radio Korea's latest English schedule shows: 0200-0300 on 7275kHz, 11,725, 11,810 and 15,575kHz; 0800-0900 on 9570 and 13,670kHz; 1030-1100 on 11,715kHz; 1900-2000 on 5975 and 7275kHz; 2100-2130 on 3970kHz and 2100-2200UTC on 6480kHz. This is only part of the schedule.

MALTA: Voice of Malta, PO Box 143, Valetta, has been testing 1800-1900 on 5890 and 9765kHz. The station requested reports on this test.

NEW ZEALAND: RNZI's new schedule shows 1650-1950 on 6145kHz; 1950-2050 on 9845kHz; 2050-2300 on 11,735kHz; 2300-0500 on 15,115kHz; 0500-0815 on 9795kHz and 0815-1205 on 6100kHz.

RUSSIA: The Voice of Russia, Moscow, has English to the Pacific: 0600-0700 on 15,490kHz, 15,560, 17,570 and 17,610kHz; 0700-0800 on 15,560kHz, 17,570 and 17,610kHz; 0800-0900 on 9810kHz, 11,800, 15,560 and 17,610kHz; 0900-1000 on 9810kHz, 11,800 and 17,610kHz; and 1000-1100 on 9810kHz, 9835, 11,800, 15,490 and 17,610kHz.

SLOVAKIA: Radio Slovakia's latest English schedule is to Australia 0830-0900 on 11,990kHz, 15,460 and 17,570kHz; to North America and South America 0100-0130 on 5930kHz, 7300 and 9440kHz. This is only part of the schedule.

SOUTH AFRICA: World Music Radio, using the Meyerton 250kW transmitters has a regular broadcast Saturday and Sunday 1800-2200UTC on 3345 and 6290kHz. Tests were carried out using a different aerial system each half hour and the best reception on 6290kHz was the period 2000-2100.

UZBEKISTAN: Radio Tashkent has English broadcasts 1200-1230 on 5060kHz, 5975 and 9715kHz; 1330-1400 on 5060kHz, 5975 and 9715kHz; and 2030-2100 and 2130-2200 on 7105 and 9540kHz. ❖

This item was contributed by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind New Zealand Standard Time.

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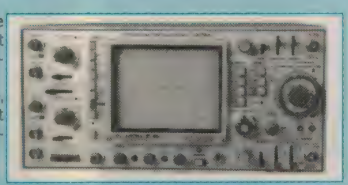

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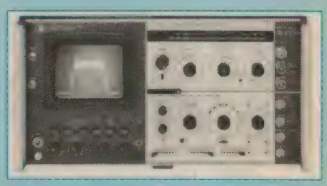

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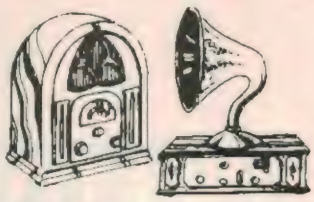
Ksam380

READER INFO NO.24

Vintage Radio

by ROGER JOHNSON



Early Radio Test Equipment — 1

Test equipment has been around for as long as radio itself, and was once just as rudimentary. Let's have a look at what was available to a radio mechanic in days gone by, to help track down faults.

The most ubiquitous of all early test instruments would have surely been the 'multimeter', used to measure volts, ohms and current. Like many of the radios of the 1920s and 1930s, a lot of these devices were home built. Most of the early meters had only DC voltage and current capability, but AC ranges followed in the later 1930s with the availability of copper/copper-oxide rectifiers.

Many of the early simple instruments comprised a 0-1mA moving-coil meter movement, with factory shunts to provide additional 0-10mA and either 0-50 or 0-100mA current ranges, and with suitable series 'multiplier' resistors to give usually four voltage ranges of typically 0-10V, 0-50V, 0-100V and either 0-500 or 0-1000V. These were considered adequate for most service work.

Construction

Most often these meters were built in a rather large case measuring approximately 10" x 8" x 2" (250 x 200 x 50mm) and sometimes used rows of banana sockets to give access to the various ranges. The test prods were simply plugged into the appropriately labelled sockets. At least one rotary switch was needed to switch between voltage and current, and sometimes between 'High' and 'Low' resistance ranges.

Sometimes, a two-pole 10 or 11 position switch was available for a fully switched instrument, to allow the use of a single pair of sockets for the test leads. But these switches were expensive, and not always very reliable. Quite often, the circuit diagrams of such meters were rather crudely drawn and very hard to follow.

Resistance ranges

The tricky bit was the resistance ranges. Given a scale of 100 graduations for full scale deflection (FSD), the minimum practical reading of a 0-1mA meter is therefore 10uA, which when used with a 1.5-volt torch battery enabled a maximum resistance reading of merely 150,000 ohms. The high ohms range needed at least a 9V grid bias battery, which would have only extended the range to 900,000 ohms. A higher voltage battery (22.5 volts for instance) gave a corresponding higher ohms range — in theory.

The trouble is, as anyone who has used an analog or 'old fashioned' multimeter knows, the resistance ranges are very cramped at the high resistance end of the scale. The reason is quite simple. For these ranges the meter is reading current, from a fixed voltage source through the unknown resistance. Mathematically, it is a reciprocal function (which incidentally has nothing to do with 'you scratch my back and I'll scratch yours!') and not a linear function as are the voltage and current ranges.

However, if the home constructor could fathom out the theory, a lower resistance range could be included by using an appropriate shunt to effectively turn the meter to a 0-10mA or 0-100mA. This allowed a correspondingly higher current to flow through the circuit with a corresponding lower resistance scale.

Voltage ranges

These are simply an application of

On the left is an early Weston multimeter of US manufacture, with range selection via many banana sockets. At right is a benchstyle 1000 ohm per volt multimeter described in Radio & Hobbies in the 1950s.

Ohms law once again. The meter this time is reading current from an unknown voltage source, but through a fixed and known resistance. On this occasion, the scale reading is linear.

A 0-1mA multimeter was said to be a '1000 ohms per volt' because that was the value of the total series resistance to read full scale from a voltage source of 1 volt. The series resistance is derived quite simply by dividing the required maximum range by the FSD of the meter. So a 0-10V range required a 10,000 ohm multiplier, and so on.

Strictly speaking, the internal resistance of the meter itself should be subtracted from this figure, but most 1mA meters had a resistance of only 100 ohms. So for ranges of 10V and above that represented less than 1% of the total resistance, and could safely be ignored.

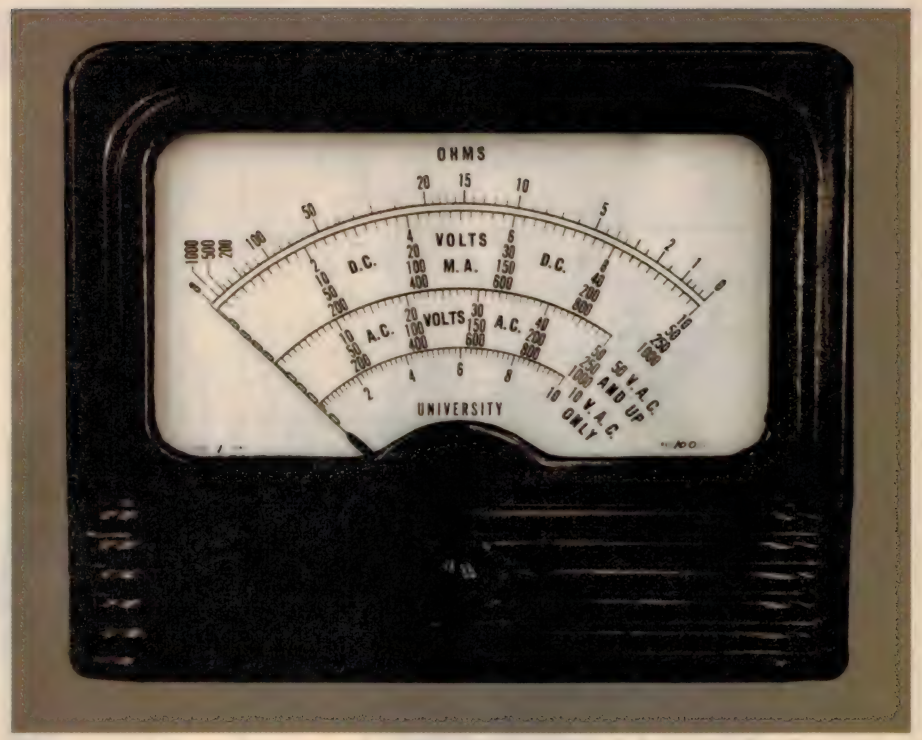
Current ranges

A shunt resistor in parallel with the meter is required to achieve higher current ranges, and to work out the current value the internal resistance of the meter must in this case be known. The formula for a given shunt is the internal resistance divided by (n-1), where 'n' is the factor by which the original meter scale is to be multiplied.

Hence, the shunt for a 0-100mA range would be equal to the meter's internal resistance, often in the order of 100 ohms, divided by 99 — or a little over one ohm.

The higher current scales meant parallel shunts of a fraction of an ohm, and these were often purchased with the meter movement as supplied by the manufacturers.

So there we have it! A typical circuit for a switched version is shown in Fig.2. Fig.1, originally in *Radio and Hobbies* for July 1939, illustrates the difficulty of following the diagram of the switching.



A closeup of a 1mA meter movement manufactured in Australia by University Instruments, showing the various scales. Note the non-linear resistance scale at the top.

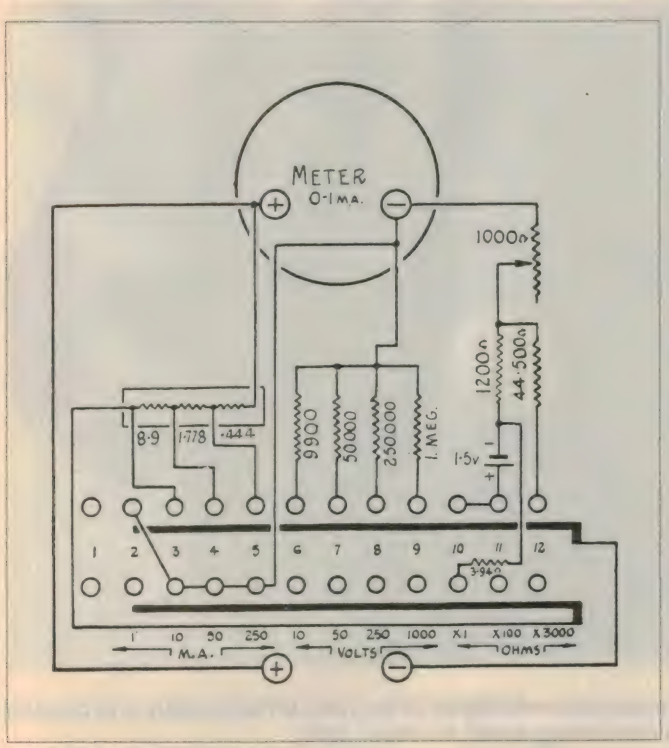


Fig.1: The circuit for a DC multimeter described in Radio and Hobbies for July 1939. Presumably the thick bars represent the moving contacts of the switch, although the wipers to the numbered contacts have not been shown.

AC ranges

For the home constructor AC ranges were added by the simple addition of a rectifier as described, an extra switch, and an additional dial scale that reflected the slight nonlinearity of the output from the Cu/CuO rectifier. These scales were once again provided by the manufacturer.

How accurate?

The limiting factor for the ohms range was the accuracy of the meter and the calibration of the scale. As long as the battery was not flat, and the meter was 'zeroed' in the usual manner, that part of the scale from about 1/5 of FSD upward could be sufficiently accurate for service work. The higher end of the scale may as well not have been there, and the higher ranges must be used, in much the same manner as an analog instrument of today. At the very highest end of the scale, a fraction of a division could easily be responsible for a 10 or 20% error!

The limiting factor for the current range was the value of the shunts, and once again, the accuracy of the dial scale. As both these items were often factory produced, they were regarded as quite accurate.

The voltage range, however, is a different kettle of fish. The accuracy here is purely determined by the accuracy of

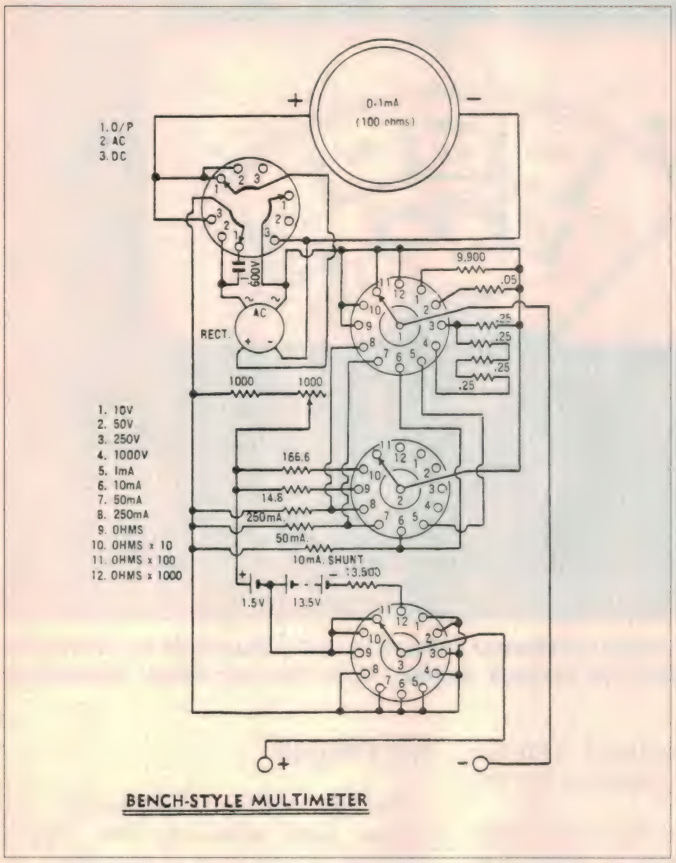


Fig.2: This somewhat clearer circuit drawing of a more sophisticated instrument appeared in Radio & Hobbies for January 1958.

the series multipliers. Resistors of 20% tolerance were regarded as satisfactory for ordinary home construction projects. 10% types were available, at extra cost, but 1% and 2% types were definitely stretching the friendship. Once again, the series shunts were sometimes supplied by the manufacturers, but at a price. Basically, you got what you paid for.

Loading effect

In certain applications the 1000 ohms per volt multimeter was notorious for its poor accuracy on the voltage ranges, but not because it used wide tolerance multiplier resistors. It all had to do with the shunting effect of the meter upon the voltage being measured. The following explanation might help.

Consider trying to measure the screen voltage of a normal pentode wired as a voltage amplifier. Typically, the value of the screen dropping resistor was 1.0 megohm, resulting in a screen voltage of about 50 volts when the screen current was 0.2mA. If the meter's 100V scale is used to measure the voltage, this effectively connects a 100kΩ resistor from the screen to earth, forming a voltage divider with the existing 1MΩ screen resistor. If the HT voltage is 250 volts, this means that 0.27mA will flow through the chain, and the screen voltage might well be so low that it may not draw any current at all. The meter will therefore now read about 27 volts!

If say, the meter's 0-1000V range is used, then 1MΩ is placed in series with the 1MΩ screen resistor — resulting in 0.125mA flowing down the chain. If the screen still draws 0.2mA, the additional 0.125mA means that 0.375mA would flow through the 1MΩ screen resistor, resulting in a voltage drop of 375 volts from a 250 volt source. This is of course is an absurdity. The screen will draw some current, a voltage drop will occur across the screen resistor, and the voltage reading will be somewhere between 27 and 50 volts — but closer to 50.

Of course trying to read 50 volts on a 0-1000 volt scale has its own scale accuracy problems!

When reading battery, normal HT or cathode voltages, and screen voltages on RF, mixer, and oscillator plate stages, such inaccuracies were markedly reduced because the higher value meter shunts were placed across much lower impedance (resistance) sources. A cathode resistor, or the internal impedance of the voltage source, such as batteries, or even a normal 250 volt power supply, are much much lower than the impedance (resistance) of the multimeter being placed across it.

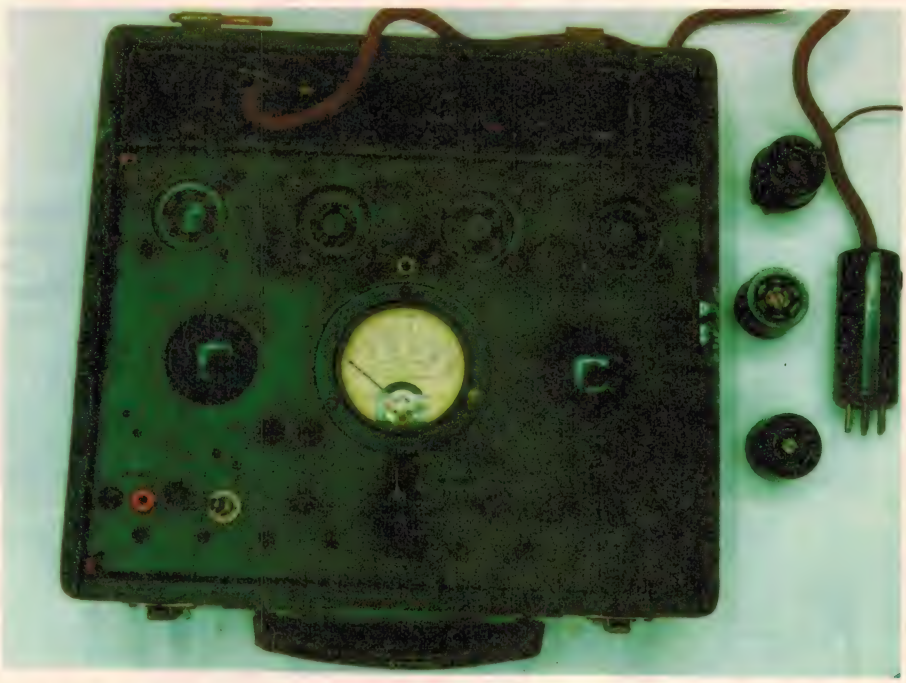


Fig.3: One of the set analysers referred to in the text. Unfortunately it is beyond restoration, but is an interesting static museum item.

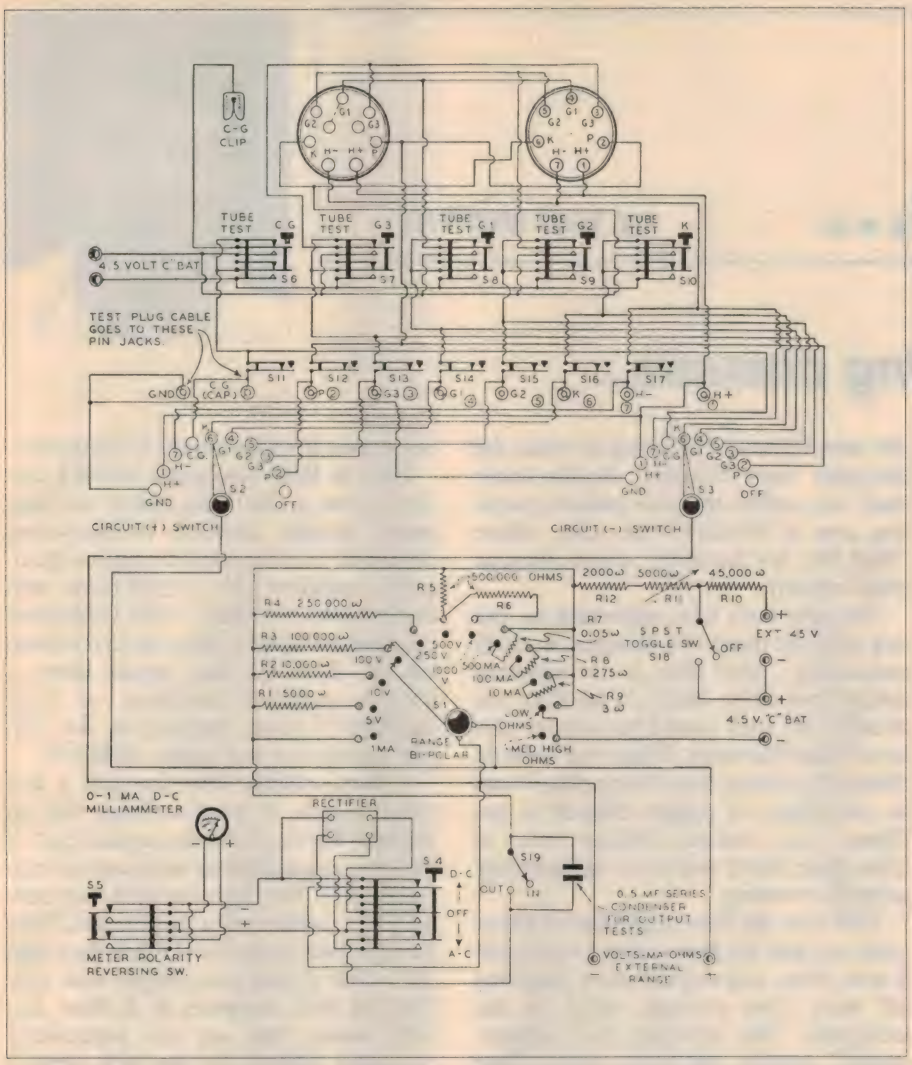


Fig.4: A circuit of a typical 'set analyser' of the 1930s, designed for home construction. Anyone game?

Work arounds

So how did the servicemen cope, back in the vintage radio days? There were one or two tricks that manufacturers adopted, which helped. Firstly, they specified the voltage to be measured on a specified range of the multimeter, thereby allowing the serviceman to compare apples with apples.

A second way they helped was by using a 'voltage divider', a large resistor with adjustable taps and a total resistance of between 15,000 and 25,000Ω, connected between HT and earth and used to derive the various intermediate voltages. This meant that there was a constant current drain across the HT of between 17 and 10mA, in addition to what was being drawn by the oscillator plate or RF screen or whatever.

If, say, the audio amp screen was to be set at 50 volts, a meter resistance of 100kΩ across that portion of the voltage divider (say 3 - 4kΩ) is going to introduced fairly insignificant loading.

Another trick was to set the mixer screen and IF amplifier screen voltages at the same level, and derive that voltage from a single screen dropping resistor. Quite often the value of this resistor was in the vicinity of 20 or 30kΩ, which again means that the shunting effect was minimal when using the higher scale of the instrument.

The 'Circuit Tester'

An extension of the multimeter was a curious device, popular in the USA in the early 30's and called a 'circuit tester' or a 'set analyser'. This device, it seems, was designed to measure voltages and currents without having to remove the chassis from the cabinet.

The idea was that a valve was removed from its socket and plugged into the appropriate socket of the set analyser. A cable with one or another adaptor was then plugged into the vacant socket on the chassis.

By judicious manipulation of a series of pushbuttons for current ranges, and switches for voltage ranges, and either more complicated switching or a series of 'wander plugs' to connect to the respective base pins, the entire operating conditions of the valve under test could be measured.

Not only that, there was often an external source of grid bias. This feature was incorporated to vary grid voltage and measure the anode current variation, thereby enabling the mutual conductance of the valve to be measured.

This method of testing valves was by far and away more superior and reliable than the equally ubiquitous and unreliable 'emission tester'.

The emission types of valve tester were standard fare for vintage servicemen in Australia, whereas the set analysers were not. Perhaps being imported and designed for the comparatively few valve types used by US radio manufacturers of the early 30's limited their appeal somewhat in this country, where European valves were as common as the US types.

The set analyser became obsolete by the late 1930's, due in no small measure to the introduction of more and more valve types. One survivor is illustrated in Fig.3. Unfortunately, the maker's plate is missing, and examination underneath shows that it has been tampered with and modified, so that restoration is nigh impossible. It does, however, give a good idea of what one looked like. A typical circuit for such a device is shown in Fig.4.

In future articles we'll look at valve testers, audio and RF oscillators and other test gear. ❖

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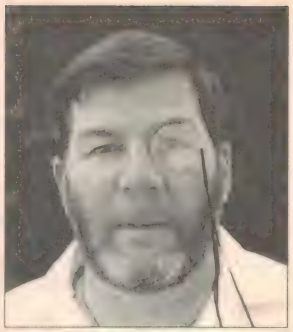
READER INFO NO.33

Moffat's Madhouse...

by TOM MOFFAT



Woes of the working classes...

Do you remember last month's Madhouse column about the TV station staff reunion? At functions like that you are supposed to REMEMBER things — faces from the past, how it was to work at that particular place. And I started doing just that, remembering how it was to work at that TV station. And then I realized just how much things have *changed*.

In my days with Hobart's Channel Six, known as TVT6 back in the early 1980s, there was a weekly ritual. Thursday was payday, and every Thursday a large proportion of the staff would pick up their paycheques at lunch time and then head off to the Black Buffalo Hotel.

We would then settle in for a very pleasant extended lunch break, for a minimum of two hours, during which we would consume enormous steak dinners washed down with plenty of beer. Later in the afternoon we'd make our way back to work, contented and happy that we'd chosen such a fine place to work. There was no problem facing the bosses when we returned; they were usually at lunch with us...

Everyday event

But that was nothing compared with my employer in the early seventies: Channel Nine in Melbourne. Here the lunchtime performance occurred every day, at the Bridge Hotel. It was the accepted practice for everyone who could, to clear out at 12:00 and stay at the Bridge until 2:00. The only requirement was that management had to know where you were. And every effort was made to keep the pay phone at the Bridge clear for incoming calls, so if you were needed you could be summoned quickly. There were no cellphones in those days, thankfully.

It was during my GTV9 days that I first learned the meaning of 'takeover' and 'retrenchment'. Once there was a major management upheaval, with the old bosses out and new bosses in. And the new bosses were going to make the business 'more efficient'. So the entire staff was called into the audience seating area in Studio 9, the place where 'Hey Hey It's Saturday' comes from to this very day.

The new boss then addressed us, but not with the usual "no changes, no staff reductions" spiel that is so common today. Instead he laid it on the line: one third of the staff would be without jobs as of that afternoon. While we were in Studio 9, notices were being distributed to the desks of people chosen to go. Those who received notices were to clear their desks and leave immediately after the meeting.

That was the first purge I ever experienced, and the first purge I survived. I was older, and experienced, and thus of more than average value to the company. The younger, less experienced people suffered most. One videotape operator got the sack while on his honeymoon.

Nowadays there is no such thing as a permanent, safe job. Every employee must spend some time looking over his shoulder. It is probably true that every manager has a mandate to reduce staff if at all possible, and if an opportunity presents itself, the manager is remiss if he/she does not act.

So behaviour as mentioned above, like having a leisurely lunch in the boozer, is an invitation for trouble. Of course there is the 'business lunch', company sanctioned and fully tax-deductible, but I'd say about 99% of *Electronics Australia* readers are not really eligible for business lunches. (*Nor are EA's own editors and staff, for that matter* — Ed.)

'Keep dancing!'

There is a saying here in the USA: If you want to keep your job you have to keep dancing as fast as you can. If somebody dances faster than you, or cheaper, or longer, you're out the door. There is no longer much sense of loyalty, either of employee to company, or company to employee. It's all a matter of economics.

Here in Port Townsend where I currently live in the USA, there are very many people talented in numerous fields, all of whom must support themselves somehow. It's a small town, with limited jobs. As well, in the USA there is a limit as to how long one can remain on the dole. So that means there is always someone knocking on your employer's door, wanting to do your job, usually for less money than you.

I faced exactly this situation a few months ago. I was working for an Internet Service Provider, a good part of the time as a telephone tech support representative. Your mission is to help new users get connected to the Internet. They are sent full instructions when they sign up — but if they just bought their new Packard Bell computer at K-Mart that very week, they are not particularly computer literate. So the tech support representative must walk them through the instructions, step by step.

Moral support

Once you've done this a few times, it's fairly routine. You are really giving moral support, not tech support. So you don't need a techno-wizz to do the job, just someone with a soothing manner. The technical expertise is already built into the instructions you're walking the customer through.

Soon the management realized they only had to pay $8 an hour for someone who could properly do the tech support job. They didn't need to pay twice that for a Tom Moffat, so guess who went bye-bye. But my skill stayed behind; I had written the instructions in the first place.

Another factor keeps coming in here, as well as pay. In today's business climate you are expected to work hard, to dance fast and to dance long. Whoever is best at this wins, whoever falls behind loses. This is the Silicon Valley Credo, and the Microsoft Way.

Well, my friends, I am here to say

right here and now that I don't do that any more. There is more to life than working hard. This lazy attitude of mine probably contributed to the loss of my last job — I balked when I was told that henceforth I was on a 50-hour week for 40 hours' pay. And it will make it harder for me to get another job, at least in the current climate. Well, then, so be it...

I see exactly the same pressures building up in Australia. I have been following the Forum column in *EA* with considerable interest, and I see two issues emerging. You readers are sick and tired of selling your considerable technical skills for a pittance. And many of you are developing a 'lazy' streak just like mine. By that I mean, you are realizing there is a lot more to a good life than just a good career.

Squeezing more...

In Forum I keep seeing 'hard work' pop up, which one New Zealand correspondent equated to 'hard life'. You are so right, my friend. Let me quote some other random snippets from correspondence I have received. From a schoolteacher in Melbourne: "Life goes on. School is well and truly in session and they appear to be squeezing more out of us than ever. Something to do with economics, I suspect."

From a Sydney woman: "I have been extremely extremely busy. For the last two weeks I have been working long hours and I have had things on nearly every night. I feel like I have hardly had any time to relax... I am feeling so worn out... in fact I feel sick... If I didn't have so much to do I would probably go home."

But, as evidenced by Forum, what hurts most is the lack of recognition for a lifetime's experience. This letter came to me from an electronics tech in Sydney: "What really got to me was taking a low-paying job with [deleted] (at 52 years old, and all they would offer was a TO2 grade) and then seeing a street cleaner's job advertised with Randwick council that offered just as much as I was getting!

"It burned me pretty badly, as I have put a lot of effort into my career as an electronics tech. I've kept up as best I could with modern technology in all its expanding fields..."

I know just how this guy feels. Had I kept my job in technical support, after more than 35 years in electronics, I would have been making the same money as the lady who checks out my groceries at the supermarket — or my own son, who with zero years' experience is now a trainee theatrical stage hand. All these jobs pay eight bucks an hour.

The positive side

Enough whingeing. There **is** a positive side to all this. I think the solution may be — you just don't be an 'employee' any more. 'Self employeed' used to be a euphemism for 'unemployed', but now maybe it's a synonym for 'smart'.

In my own case, since I've left my 'real job', my life has improved considerably. I traded one job for four jobs. I'm still doing computer tech support, but now it's in people's offices and homes, rather than over the phone. I meet some extremely technically challenged computers — Elwha (Madhouse, March 1997) was only the start. And it's fun!

I'm also back at Port Townsend High School and the Community Auditorium, doing sound and lighting and television production, for twice the money I got doing Internet telephone tech support. I'm playing music in two bands, and of course I'm now in my eighteenth year of writing for Federal Publishing. Most importantly, I'm doing WHAT I DAMN WELL ENJOY!

Interesting book

I've recently been reading an interesting book called *Cybercorp*, by James Martin. That's right, virtual companies that only exist as packets of data flitting about on the Internet. It's kind of a complicated concept, but the Cybercorp model seems to be a collection of people, working away at their computers, anywhere in the world, toward a common commercial goal. None of them actually 'work' for the company, they are contractors.

The Cybercorp itself grows and shrinks with the workload. I visualize it as kind of a dynamic memory heap in a computer, that grows and shrinks with the demands placed upon it. Every worker in the Cybercorp realizes there is no such thing as permanence, but every temporary job lost will be quickly replaced by another one. As James Martin puts it, "the Cybercorp should be designed for continuous change, not periodic Hiroshimas". Thus downsizing, and upsizing, are just the Cybercorp organism living and breathing.

So it's goodbye to job security as we know it. Is this such a bad thing? Probably not, once you get used to it. I've spent a good part of my life self-employed (all right, UNemployed), but I've never starved, and so far I've never had to tap the government for assistance. With several part-time jobs going at once, if one slacks off another seems to expand to fill the hole.

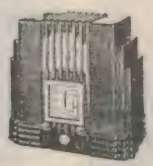
For instance yesterday, I spent the day happily fighting with a totally screwed-up computer. Today no computer calls, so I'm spending the day writing a Madhouse column. Tomorrow and for the following two days I'm doing a big sound job at the high school. If I add up all the income generated this week, it ain't bad at all.

There's one big difference between what I'm doing and James Martin's Cybercorp. I gather that all Cybercorp work is to be done in front of a computer, in isolation from other human persons. I couldn't take that; I need company. The way it works now, I meet some new life form every time I meet a new computer. When I'm working at the auditorium, by definition I am working with a crowd. In the band, I am performing before a crowd. Humanity everywhere!

The only time I am in isolation is when I'm writing this stuff; there's just me and my laptop. But you have to have some privacy sometimes, and it's not *truly* private — because I'm pouring out these thoughts, and you're reading them. Aren't you? Please? ❖

A PIECE OF RADIO HISTORY

Purchase a fully restored AUSTRALIAN vintage radio from the specialists



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50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

August 1947

Engineer listens for sky signals: American engineer Grote Reber has built a large dish antenna in the backyard of his home in Wheaton. The huge dish faces the southern sky and can be tilted at any angle of declination along the north-south meridian. The radio waves captured by the dish are directed to the mouth of a drum containing a radio amplifier. This converted electromagnetic energy is heard as it swishes over his super-sensitive receiver, and he uses a chart recorder to prepare 16-hour daily reports of radio activity transmitted from the Sun and other bodies.

The listening post not only serves him as a hobby, as when he trains his device at Mars and other stellar bodies to probe them for human intelligence, but is also the means through which he is conducting experiments on the measurement of electromagnetic energy at radio wavelengths arriving from the sky. Reber says he receives ultra-high frequency radio waves when he focusses on the Milky Way, the Sun and Mars. He began his astro-physical experiments 10 years ago.

August 1972

Flat computer display: A flat panel display has been announced by Burroughs to replace the CRT in computer terminals. The 14.5 x 9.4 x 2.2 inch picture-frame style display weighs only 7.5 pounds, making it easily transportable in an office.

Designated the TD700 Self-Scan Terminal, the system is claimed to be the first commercially viable product to use the gas discharge matrix technique. Individual gas-filled cells in a honeycomb configuration are selectively ionised and illuminated to display the various characters. The character size is 0.2 x 0.28 inches high and is built on a 7 x 5 dot matrix.

One reason the system is now feasible is that Burroughs has eliminated about 90% of the addressing electronics which was necessary with earlier design attempts.

Video phones poised for take-off: After years of experimental work and predictions that video telephone service is 'just around the corner', telephone manufacturers finally have video phone hardware in use commercially.

Bell Telephone's PicturePhone service, initiated in Pittsburgh in 1970, is gradually becoming available in other US cities as central telephone offices are modified for video service. PABX switching services for up to 10 video phones are standard equipment, but custom switching has been installed for larger numbers of stations.

Initial customers for video phone systems are expected to be medium-to-large companies. ❖

EA CROSSWORD

ACROSS

1 Popular Microsoft GUI. (7)
5 Operational mode of a tape player. (7)
9 Bells. (7)
10 Name of spacecraft investigating other planets. (7)
11 Susceptibility changes at this temperature. (4)
12 Detect. (5)
13 Driving most VCRs. (4)
16 Name of exclusion principle. (5)
17 Person skilled in small repairs. (8)
21 Circuit component. (8)
22 Who developed and named the coherer? (5)
25 Secondary cell type. (2-2)
27 Invented holography. (5)
28 Variations in brain potential cause .... waves. (4)
31 Name of analysis of complex waveforms. (7)
32 New major joint venture in satellite communication. (7)
33 Type of file. (7)
34 Adjusted for better performance. (7)

SOLUTION TO JULY 1997:

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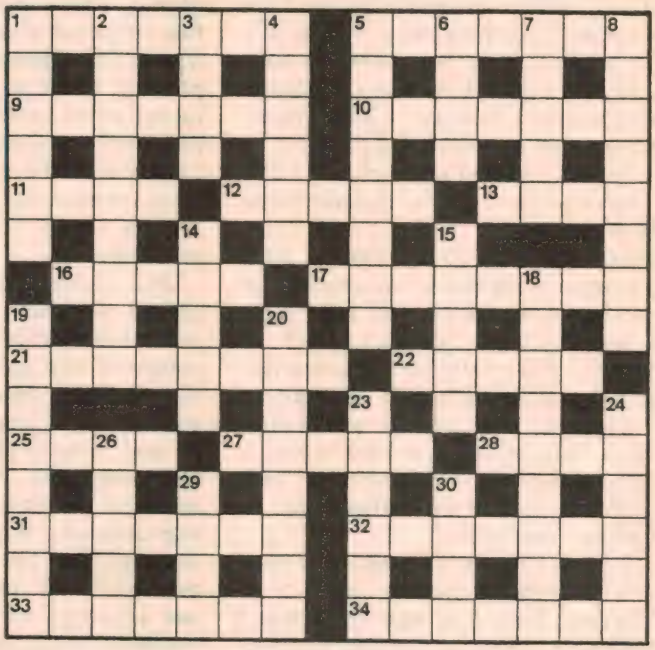
	G	R	A	T	I	N	G		M	A	X	E	L	L

DOWN

1 Part of circuitry. (6)
2 Group of elements. (3-6)
3 Break a circuit. (4)
4 Interacting group of devices. (6)
5 Rating of the Southern Cross? (4-4)
6 Normal lines of wave propagation. (4)
7 Means of showing phase difference. (5)
8 Reducing duty limits on equipment. (8)



14 Opposite to 3 down. (5)
15 Stores much data. (1,1-3)
18 Basic property of Earth. (9)
19 Copy information, image, etc. (8)
20 Non-stereophonic. (8)
23 First surname of discoverers of radioisotopes. (6)
24 A transmission blocked. (6)
26 Local failure; flaw. (5)
29 Popular opera by Verdi. (4)
30 Musical instrument digital interface. (4) ❖

Electronics Australia's

Professional Electronics

S • U • P • P • L • E • M • E • N • T

MICROCHIP SENSOR REGISTERS FINGERPRINTS USING DIRECT CONTACT, VIA AN ARRAY OF CAPACITIVE SENSOR CELLS

REVIEW OF HP'S LOGICDART ADVANCED 3-CH LOGIC PROBE, SAMPLING AT 100MS/SEC

MICROCONSULTANTS' SPLAT SL88: AN EASY TO USE $150 PROGRAMMABLE CONTROLLER

INTEL'S NEW PENTIUM II PROCESSORS, IN THEIR SINGLE EDGE CONTACT PACKAGE: 233, 266 & 300MHZ VERSIONS, COMBINING THE ADVANCED TECHNOLOGIES OF THE PENTIUM PRO WITH THE MULTIMEDIA POTENTIAL OF THE 57 EXTRA MMX INSTRUCTIONS, PLUS DUAL INDEPENDENT BUSES...

NEWS HIGHLIGHTS

INTEL RELEASES PENTIUM II PROCESSOR

Intel Australia has launched the Pentium II processor, claimed to bring new levels of performance and visual computing capabilities to business desktop and workstation users. The Pentium II processor, introduced at speeds of 300, 266 and 233MHz, combines the advanced technologies of the Pentium Pro processor with the capabilities of Intel's MMX media enhancement technology.

"With the expansion of visual computing into business, the performance of both processors and PCs must increase more than ever before", said David Bolt, General Manager, Intel Australia. "Among new users, we envision the PC routinely translating all types of raw data into rich 3D models in seconds, helping users better assimilate the information at hand. Interactive business transactions will combine video, realistic graphics and audio to educate or demonstrate new products or services to potential customers."

More than a dozen leading computer manufacturers in the Asia-Pacific region are already marketing desktop systems incorporating the 266MHz and 233MHz Pentium II processors. The 300MHz processor will be available in workstations in the third quarter.

The Pentium II processor combines high performance technological advancements to improve floating point, multimedia and integer performance. These include Dual Independent Bus architecture, first implemented in the Pentium Pro processor, which addresses the bandwidth limitations of previous-generation processor architectures; MMX technology, which has been added to the Pentium II processor to enhance performance for audio, video and graphics applications as well as to speed up data encryption and compression; Dynamic Execution technology, which extends the raw performance of the processor by allowing more data to be processed in parallel in a given period of time; and a new Single Edge Contact (SEC) cartridge delivery vehicle, claimed to provide headroom for future, higher performance processors.

Like the Pentium Pro processor, the Pentium II processor has a closely coupled L2 cache design, which helps the processor achieve higher performance. In the Pentium II processor, the L2 cache is comprised of industry-sourced Burst SRAMs.

VIDEO PROJECTOR PRODUCES 5000 LUMENS

Digital Projection Inc., a subsidiary of UK firm Digital Projection Limited, has unveiled a new video projector capable of producing extremely bright images — claimed in excess of 5000 ANSI lumens. The new projector is based on Texas Instruments' Digital Micromirror Device (DMD) technology.

"Our POWER 5dv uses the same chassis as the POWER 4dv", said Mike Levi, president of Digital Projection's North American operations, "but is driven by an even more powerful Xenon arc lamp combined with advanced thermal management and optical systems, to increase light output by nearly 50%."

Digital Projection's POWER 5dr features non-pixelated, film-like images, factory pre-converged light valves, a claimed luminance uniformity greater than 90%, and stable colour reproduction throughout the lamp life. It's designed for use in demanding large-screen applications in leisure and entertainment, business, education, simulation, command and control, staging and rental markets.

Source compatibility includes PAL, SECAM, NTSC, VGA, SVGA, XGA, and MAC graphics formats up to 1024 x 768 resolution. A choice of interchangeable lenses provide optical solutions for the most demanding arena, stadium, large-venue or rear screen applications. The illumination system is designed around a powerful and compact, extended-life Xenon arc lamp, proprietary to Digital Projection.

The Digital Projection 5dv and 4dv are claimed to represent the highest-level execution of Texas Instruments' three-chip Digital Micromirror Device (DMD), with light output and performance eclipsing CRT, LCD and light valve projection alternatives. (Business Wire)

WINNER OF 68HC05 DEVELOPMENT SYSTEM

The winner of the Oztechnics 68HC05 competition announced in our May 1997 issue was Mr Stephen Wilson, of Camp Hill in Queensland. Mr Wilson has been sent his Oztechnics

68HC05 Development System, and we congratulate him for his initiative. We'd also like to thank the many other readers who sent in entries for this competition, for their interest and support.

PHILIPS EXPANDS NIJMEGEN WAFER FAB

To support volume production of its new fifth-generation RF wideband transistors, Philips is investing a further US$15 million in the company's state-of-the-art discrete products wafer fab at Nijmegen, Holland. This represents yet another step in Philips' plans to make the Nijmegen facility, already the largest semiconductor plant in Europe, the world's leading source of discrete RF products and modules.

As a result of a general expansion of the discrete products fab, one of five separate wafer fabs on the Nijmegen site, its total production area of 3000 square metres is now fully operational, with all critical wafer handling areas meeting Class-100 clean room conditions. Existing products manufactured in this facility include general-purpose broadband transistors, video modules, CATV modules, cellphone RF power modules and transistors, and modules for cellular basestations. Both MOS and bipolar technologies are currently used in the manufacture of these products, several of which require processing to sub-micron geometries.

The additional US$15 million will be spent equipping the wafer fab with the specialist equipment required in the double-polysilicon process that is used to produce Philips Semiconductors' new range of fifth-generation RF wideband transistors.

WINNER OF THE FLUKE 18 METER

The winner of our Fluke 18 Automotive Meter Competition, as announced in our May 1997 issue, was Mr Graeme Burrow of Colonel Light Gardens in South Australia. Mr Burrow has received the Fluke 18 Meter, valued at $219, and kindly donated by Dick Smith Electronics.

We congratulate Mr Burrow on winning the meter, and would also like to thank all of the many readers who sent entries for this competition, for their interest.

MICROCHIP SENSOR REGISTERS FINGERPRINTS

SGS-Thomson Microelectronics has demonstrated the first working prototype of a microchip that can directly register the pattern of a human fingertip, detecting variations in the electrical currents running along the ridges and valleys of the skin. The prototype was demonstrated at the CardTech-SecurTech Conference in Orlando, Florida.

The patented electronic fingerprint imaging sensor differs substantially from existing technologies. Through direct physical contact, the sensor array 'grabs' a fingerprint pattern without using an optical or mechanical adaptor such as a scanner or camera. When the finger is placed onto the chip's silicon surface, the capacitive sensors register the fingerprint pattern by interacting with electric field variations produced by the skin's ridges and valleys. The chip then creates an electrical representation of a fingerprint. The new technology is claimed to offer superior greyscale image quality and a direct route to the digital information used in the personal identification process.

"This offers a new dimension in the arena of biometrics, which is emerging as a key technology for security and identification," according to Alan Kramer, Director of the Innovative Systems Design Group of SGS-Thomson's Central R&D Division. "Some of the security applications for this electronic fingerprint imaging sensor include PC access, electronic security for internet transactions, physical identification for access to automobiles and buildings, and Personal Identification Number (PIN) replacement, as well as applications in the smartcard, appliance and portable electronics fields."

Compared with alternate personal identification methods such as infrared and retinal scans, the electronic fingerprint technology provides heightened security, ease of use and cost benefits. The compact one-chip solution is smaller and lower in power consumption than optical methods, consuming less than 1mW at 5V. It also generates higher image quality than most other identification methods, including technologies based on heat.

Since the chip's pixels are on a pitch of more than 25um, it can be easily integrated into standard CMOS technology as used to produce today's microprocessors and other common chips.

The live fingerprint imager is based on a feedback capacitive sensing scheme. Two metal-2 plates are placed adjacently in the cell area and separated from the skin surface by the passivation oxide. The skin surface can be thought of as a third plate opposed to the metal-2 ones and separated by a dielectric layer with variable thickness, composed of air.

From a lumped-model point of view, this structure forms two series-connected capacitors. The metal-2 plates are separately connected to the input and output of a high-gain inverter, thus forming a charge integrator.

Since the distance between the skin and sensor identifies the presence of ridges and valleys, an array of cells is used to sample the fingerprint pattern. The array is addressed in raster mode by means of horizontal and vertical scanners. The chip also contains timing control and voltage references.

The current prototype is able to capture a fingerprint image at 390dpi, enough to provide high-reliability fingerprint matching based on image processing algorithms. Future prototypes are expected to increase resolution to as much as 750dpi.

CSC AUSTRALIA WINS SAT COMMS CONTRACT

CSC Australia has won a multi-million dollar export order to develop software for a mobile satellite communications network that will operate in Europe. The export contract will provide work for 20 software engineers working out of CSC Australia's Adelaide office during the next 12 months.

CSC Australia signed the contract with NEC Australia, which will provide ground station equipment and services, and mobile terminals to telecommunications carrier Nuova Telespazio SpA. in Italy. Owned by the Italian Government, Nuova Telespazio manages all Italian satellite activities within the IRI-STET Group.

Nuova Telespazio's M-SAT Mobile Telephone System will provide voice, fax, data and short message services using the European Mobile Satellite payload of the Italsat F2 satellite.

Under the $4 million contract, CSC Australia has provided an initial set of software and computer hardware similar to that developed for the Australian Department of Defence's Interim Defence Mobile Communications Network (DMCN).

Jaycar Electronics recently conducted a 'Win a Trip to South America' promotion in its stores. The lucky winner was Mr Dave Warren (R) of Minchinbury NSW, here being congratulated by Penrith store manager Phil Routley.

BELL LABS SETS F-O LASER RECORD

Bell Labs scientists, working with colleagues at Opto Power Corporation in Tucson, Ariz., have demonstrated record-setting output powers from optical-fibre lasers. The fibre lasers, each pumped by a single semiconductor laser and with the output coupled directly into a single-mode fibre, produced from 8W to 21W of power.

The research team has built a cascaded Raman fibre laser with an output power of 8.5W at 1472 nanometres; the laser could be used to boost communications signals in long-haul communications systems. Conventional lasers used for this purpose typically produce only 0.1 of a watt. They've also built fibre lasers, with ytterbium-doped fibre cavities defined by two-fibre Bragg gratings, that yield 16.4W of power at 1065nm and 20.4W at 1101nm, into a single-mode fibre. The lasers' output power levels are about 80 and 300% higher than other single-mode fibre lasers operating at 1065 and 1100nm, respectively.

The fibre lasers were pumped by a single high-power laser diode array with more than 40W of optical power at 915nm. In these high-power fibre lasers, light from a semiconductor laser is guided within the outer layer, or cladding, of a specially developed fibre with a single-mode core containing the rare-earth element ytterbium. The light is absorbed by the ytterbium, which changes its wavelength and makes it possible to 'pump' optical amplifiers that boost communications signals. They make it possible for the signals to travel longer distances and are powerful enough to be used as a single source for distribution of the signals, through a router, to many users. (Business Wire)

HEWLETT HONOURED BY ROYAL SOCIETY

William R. Hewlett, co-founder and director emeritus of Hewlett-Packard Company, has accepted the 1997 Benjamin Franklin Medal awarded by the Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA).

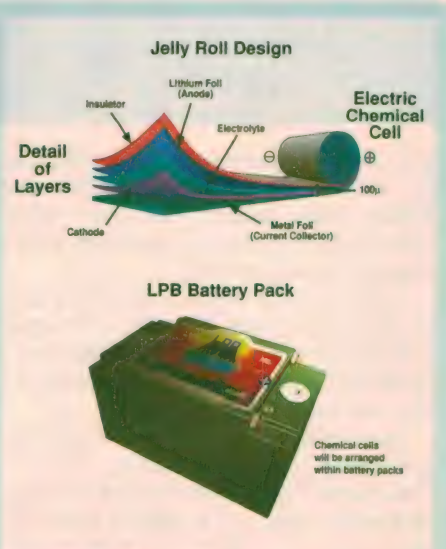
The Benjamin Franklin Medal was instituted in 1956 to mark the 250th anniversary of the birth of Franklin, and the 200th anniversary of his election to membership of the RSA. The Medal is awarded annually, alternately to citizens of the United Kingdom and of the United States who have forwarded the cause of Anglo-American understanding and cooperation, particularly in the fields of arts, manufactures and commerce.

Mr Hewlett received the 1997 Medal

USABC BACKS MORE LP BATTERY RESEARCH

3M has been awarded an additional US$24.5 million for continued development of Lithium Polymer Batteries (LPB) by the United States Advanced Battery Consortium (USABC), according to Dr William Coyne, 3M executive vice president of Research and Development. USABC also recently granted a US$14.5 million two-year contract to Duracell Inc. and Varta for their work on a Lithium Ion Battery (LIB).

While both batteries use lithium, the LPB has a solid state design. In addition, when compared with other battery technologies currently in use or under development, the LPB has the best combination of high specific energy and long cycle life. The LPB has an expected specific energy of 200 watt-hours per kilogram and a cycle life comparable to the expected lead-acid cycle life of greater than 600.

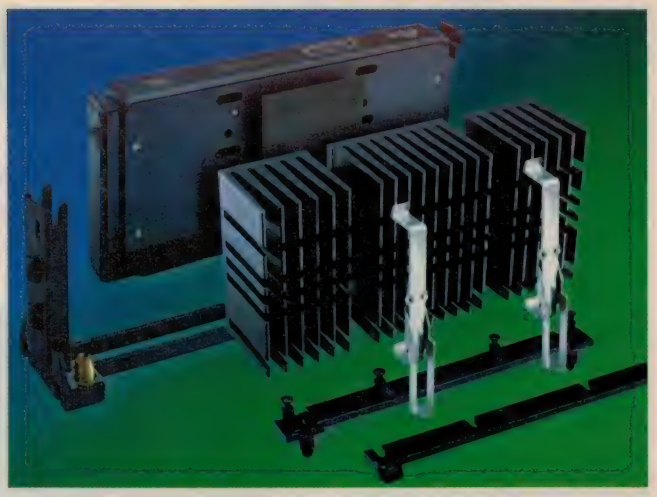


For electric vehicles to compete effectively with conventional internal combustion engines, the battery must allow vehicles to reach a range of 150 miles or more. Currently, lead-acid batteries produce approximately 35Wh/kg., which allows electric vehicles to travel less than 100 miles per charge.

LPB technology has been developed under USABC since 1993. 3M has been a leading force in this effort and was awarded two contracts previously. (Business Wire)

in recognition of his entrepreneurial achievement, his pioneering management practices and company values, and his contributions to technology, science, education and medicine.

The medal was presented by the Hon. George P. Shultz, former US Secretary of State and Distinguished Fellow of the Hoover Institution on War, Revolution and Peace based at Stanford University, and by RSA Chairman of Council Ms Prue Leith OBE, on May 28, 1997 in California.



How do you keep Intel's new Pentium II cool, in its vertical SEC cartridge? Aavid Thermal Technologies has developed a new family of heatsinks designed specifically for the job. For more information see Aavid's web site at http://www.aavid.com.

IBM RELEASES 8.4GB 3" HARD DISK

IBM has announced a record-breaking 8.4-gigabyte hard disk drive for high performance desktop personal computers, called the Deskstar 8. The world's first desktop PC drive using IBM's MRX (Magnetoresistive Extended) head technology, the 3" drive sets a new world record for data density: 1.74 billion bits per square inch.

Deskstar 8 also features Ultra Direct Memory Access/33 (DMA/33) technology, delivering high transfer rate performance. The drive spins at 5400rpm, has an ATA-3 interface, uses four platters and incorporates a 512KB data buffer. It offers 9.5ms average seek time, 5.6ms average latency, 5.8MB/s minimum sustained transfer rate and 76.2 - 127.4MB/s media data rate.

DIGITAL TO USE AMD'S K6 PROCESSOR

AMD has announced that Digital Equipment Corporation will use the AMD K6 MMX enhanced processor in its Venturis desktop computer family. The new K6 processor-based Venturis FX-2 systems will run at clock speeds from 166MHz to 233MHz and are predicted to be among the best value desktop systems in the industry for commercial computing environments. The US selling prices are expected to start at US$1250. The new systems include the Intel 430TX PCI chip set, three DIMM sockets, 64-bit SDRAM interface, a 256KB pipeline-burst secondary cache and system memory expandable to 256MB. Pre-installed software includes Microsoft Windows 95 or Windows NT 4.0 operating systems, and Digital's ClientWORKS systems management and control software.

TOSHIBA & CHARTERED TEAM FOR EMBEDDED DRAMS

Toshiba Corporation of Japan and Chartered Semiconductor Manufacturing of Singapore have entered into a five-year partnership agreement that calls for technology and manufacturing cooperation on embedded DRAMs, a burgeoning semiconductor business segment based on leading-edge system on silicon technology.

Under the terms of the agreement, Toshiba will license its embedded DRAM technology to Chartered, beginning first with 0.35um and migrating to 0.25um. After process qualification, Chartered will manufacture embedded DRAM products for Toshiba and other customers.

The first embedded DRAM products produced under the partnership are expected to emerge in the market in 1998. The 0.35um and 0.25um embedded DRAMs will be manufactured in Chartered's new Fab3, which will serve the company's diverse customer base.

These embedded DRAMs will employ trench-capacitor technology, currently used in Toshiba's 16MB and 64MB DRAMs.

Embedded DRAMs integrate traditional DRAMs with digital logic on the same chip, using a common process. Such integration offers lower package count and reduced power dissipation.

NAVAL AMATEUR RADIO SOCIETY

The Australian Naval Amateur Radio Society (ANARS) is inviting enquiries from all radio amateurs and shortwave listeners who have a professional naval or marine background. ANARS offers the opportunity to enjoy amateur radio activities in company with 'kindred souls of the sea'.

Society members conduct weekly nets on Mondays at 0930 UTC in CW on 3532kHz, and on Wednesdays at 0930 in SSB mode on 3620kHz. They also conduct daily SSB nets at 0400 on 7075kHz and at 0430 on 14,175kHz. The Society also promotes various awards and publishes regular issues of *QUA*, the official journal of the Society.

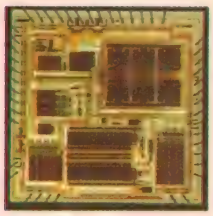
For further information contact the secretary of ANARS at 13 Brothers Road, Dundas 2117, phone (02) 9638 3569, email to **fayem@sydney.dialix.oz.au** or simply join one of the nets. ❖

NEWS BRIEFS

- The 9th Australian International Electrical and Electronic Industries Exhibition ***Elenex Australia*** is being held at the Sydney Darling Harbour Convention and Exhibition Centre, August 26-29, 1997.
- ***Advanced Security Systems*** has appointed Bernie Harrison as sales engineer to the company's Brisbane office.
- New Zealand firm ***General Communications*** has been appointed distributor for the Tektronix range of measurement products. The distribution agreement is not a new alliance, as General Communications has been distributor of Tek's range of broadcast television production equipment in NZ for five years. Tek's range of hand tools products will continue to be available from Components and Instrumentation (C&I) and Farnell Components.
- Loudspeaker system manufacturer ***Richter Acoustics***, now owned by Audio Products International (Australia), has moved to a new and considerably larger factory at Wetherill Park. The new address is Unit 1/6 Muir Place, Wetherill Park 2164; phone (02) 9604 8799, or fax (02) 9604 8254.
- Logictech Inc., international marketers of control devices and imaging peripherals for personal computers, has appointed ***Dataflow Computer Services*** as a distributor in Australia. DCS is located at 1 George Place, Artarmon 2064; phone (02) 9417 9700, or fax (02) 9417 9797. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY...



Telecom protection device

The CLP200M is a new protection device from SGS-Thomson Microelectronics that provides transient overvoltage and overcurrent protection for telecom lines. It is specifically designed for use in analog and ISDN line cards, PABX systems and other telecom equipment for protection against lightning surges and other dangerous transients.

It is a dual bidirectional device with a peak pulse current rating of 100A for a 10/1000us surge and provides assured protection against lightning surges up to 4kV, and longer duration surges caused by mains coupling or mains contact.

Other key features include a maximum voltage at switch-on of 290V, a minimum current at switch-off of 150mA and a failure status output pin that provides a signal whenever the CLP200M is shorting the line to ground. This signal can be used to drive a warning LED or as an input to a fault counter circuit.

For further information circle 273 on the reader service coupon or contact SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street Hurstville 2220; phone (02) 9580 3811.

Chipset for satellite broadcasts

Analog Devices has announced SATCOM2, a highly integrated chipset that combines all the functions needed to capture and process high quality audio/video signals in direct broadcast satellite (DBS) equipment. The AD6461 analog signal processor accepts 480MHz intermediate frequencies from commercially available L-band tuners and demodulates QPSK components. A pair of onboard 'tunable bandwidth' filters optimise bit error rate and reduce noise and distortion.

Filtered analog signals are passed to the AD6462, where they are digitised, error corrected and formatted as an MPEG-2 transport data stream. The resulting signal output format conforms with the open transmission and coding protocol specified by the Digital Video Broadcast (DVB-S) launch group.

For further information circle 280 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755. Web site: **http://www.analog.com**.

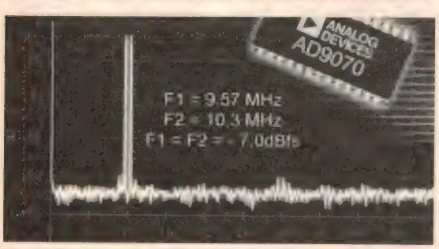
Virtual Dolby surround sound IC

Medianix Semiconductor has announced that its MED25006 single-chip, digital Virtual Dolby surround processor has been certified by Dolby Laboratories and that volume production of the chip has started. The IC uses 24-bit DSP technology to implement a 3D surround sound algorithm that creates the effect of front and rear speaker pairs using only two speakers. A subwoofer audio output is also supported. Applications include consumer audio products that cannot accommodate more than two speakers, such as desktop computers, televisions and arcade games.

Virtual Dolby surround technology was unveiled by Dolby Laboratories in January 1997, and Medianix Semiconductor demonstrated its single-chip implementation of the audio algorithms on the same day. The chip also supports Dolby Pro Logic decoding for original four-channel plus subwoofer surround sound systems; Dolby 3 stereo output, with left, right and centre channels; and mono to stereo synthesis. The chip also contains 'sweet-spot' adjustment to compensate for placement of speakers relative to the listener.

For further information circle 272 on the reader service coupon or contact Medianix Semiconductor Inc, 100 View Street, Suite 101, Mountain View, California 94041; phone + 415 960 7081, fax +415 960 0478.

ADC has 230MHz bandwidth



The AD9070 from Analog Devices is a new 10-bit sampling analog to digital converter (ADC) with a usable bandwidth of 230MHz, a 100MS/s sampling rate, and a power dissipation of 600mW (typical). Applications include point-to-point and satellite communications, direct IF sampling in communications systems, high definition television, spectrum analysers, radar, medical imaging, digital oscilloscopes and transient recorders. The ADC operates from a -5V supply and needs an external encode clock to operate. It has an out-of-range indicator and comes in a 28-pin plastic SOIC package.

For further information circle 279 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755. Web site: **http://www.analog.com**.

3.3V SRAM modules

White Microelectronics now has available 3.3V commercial grade 4Mb and 16Mb SRAM MCMs with JEDEC standard 68-lead PLCC packaging. The devices are designed for 3.3V processors and meet the requirements of typical networking systems, ISDN, ATM, VME boards, fax/modem cards and other applications requiring high density SRAM for surface mount boards.

The 4Mb SRAM, WPS128K32V-XPJC, is organised as 128K x 32 and has access times of 15ns to 25ns. The 16Mb SRAM, WS512K32BV-XCJC, is organized as 512K x 32 and is user configurable as 1M x 16 or 2M x 8. Access times are 15ns to 20ns. The modules are based on BiCMOS technology.

For further information circle 278 on the reader service coupon or contact Philip Farahmand, White Microelectronics, 4246 East Wood Street, Phoenix, AZ 85040; phone (602) 437 1520. Internet **http://www.whitemicro.com**.

SOT223 temp sensor

A 1000 ohm platinum temperature sensor in a standard SOT223 plastic package has been released by Heraeus Sensor-Nite. The device is designed specifically for measuring and compensating for the temperature of a printed circuit board. The cooling fin of the package optimises thermal contact to the circuit board and the device measures with an accuracy of +/- 0.5% over a temperature range from 50 to 150°C.

For further information circle 277 on the reader service coupon or contact Heraeus Sensor-Nite GmbH, Reinhard-Heraeus-Ring 23, D-63801 Kleinostheim; phone +49 6181 355 211.

CCD signal processor IC

Analog Devices has introduced the first members of a new imaging product family that performs decoding and signal processing in a single IC. The 10-bit AD9805 and 12-bit AD9807 CCD (charge-coupled device) signal processors combine a three channel correlated double sampler, programmable-gain amplifiers, digital gain and offset correction. Applications include desktop scanners, electronic camera backs and 35mm film scanners.

The devices convert the output from CCD and contact image sensor (CIS) modules to digital data. They need no external support circuitry, operate from a +5V supply and come in a 64-pin plastic quad flatpack (PQFP) surface-mount package.

For further information circle 276 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755.

Introducing the Industrial ScopeMeter Test Tool:

FLUKE

More Ways To Find The Trouble Fast

The new Fluke 123 Industrial ScopeMeter is a 20MHz dual channel DSO, dual channel 5000 count meter and a date-stamped recorder – *all in one hand-held package.*

- Connect-and-View™ hands-off operation runs through an entire troubleshooting sequence without ever touching a button! Excellent trigger facilities include video and pre-trigger.
- Intuitive ease of use with unique "single test lead does all measurements" capability. One and the same test lead for waveform displays, multiple meter readings, capacitance and resistance measurements and continuity checking.
- Safety-designed and certified for measurements on 600 Vdc, 600 Vac rms/(1700 Vpk-pk). It works with a wide range of Fluke accessories including current clamps and temperature probes.
- Large, high brightness cold cathode fluorescent backlit display has excellent contrast and visibility from dark corners to broad daylight.
- Optional printer and PC interface as well as optional Windows software makes documentation tasks simple.
- Three-year warranty.

Also available Fluke 'B' Series ScopeMeters to 100 MHz. We stock a full range of multimeters, probes, holsters and other accessories. Call us with your requirements for technical advice.

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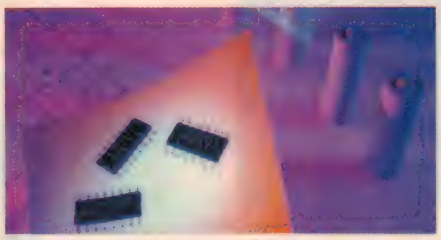
READER INFO NO.27

Battery disconnect switching IC

An integrated battery disconnect switch that can be used with NiCad, NiMH, and lithium ion cells has been released by Temic Semiconductors. The new Si4720CY is claimed to be the industry's first such device to integrate P-channel power MOSFETs and level shift circuitry in the same package. This combination provides the reverse blocking capability needed for power supply designs which use multiple battery types, or for those that need isolation



from the power bus during charging, both of which are typical of portable computers and portable instruments.

Because the MOSFETs work as high-side switches, the IC is said to eliminate the need for 12 or more discrete components, and allows battery switching to be controlled directly from a microprocessor. The two switches can be used separately for functions such as controlling the charge of the battery, or switching between the battery and the AC adaptor. They can be used together or in conjunction with Schottky diodes to provide the reverse blocking capability necessary for switching between two battery packs.

For further information circle 274 on the reader service coupon or contact Braemac Pty Ltd, 1/59-61 Burrows Road, Alexandria 2015; phone (02) 9550 6600.

12-bit ADC with instrumentation input

Burr-Brown's new ADS7817 is a 12-bit, 4mW, 200kHz sampling analog to digital converter with instrumentation amplifier input. It features a high impedance, full differential, bipolar input range with 80dB common-mode rejection, making it suitable for motor control and industrial process control applications. Other applications include battery operated systems such as watches, smoke detectors and home medical appliances.

The device operates down to +100mV with an external 100mV reference. Other features include low power (2.3mW at 200kHz), 3uA power down, synchronous serial interface, and AC common mode rejection.

For further information circle 281 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700. ❖

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18	43	68	93	118	143	168	193	218	243	268	293
19	44	69	94	119	144	169	194	219	244	269	294
20	45	70	95	120	145	170	195	220	245	270	295
21	46	71	96	121	146	171	196	221	246	271	296
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Hurry! Offer Ends 19th August, 1997.

HP's LogicDart

Hewlett-Packard describes its new LogicDart as an 'advanced logic probe'. After trying one out for a short time, we can certainly agree. It combines a traditional logic probe with a 3-1/2 digit DVM/ohm meter, a 33MHz frequency counter and a three-channel 100MS/s logic timing analyser — all in a handy handheld package only slightly larger than a compact DMM!

by JIM ROWE

Not all that long ago, logic probes were little more than a couple of comparators in a probe body, driving red and green LEDs. Many of us built one ourselves, and the simplest versions did little more than indicate a logic 'high' or 'low', generally for one particular logic family (say TTL, or CMOS).

The more elaborate models would indicate the high-impedance 'tristate' condition as well, and if you were ambitious they might also have a latch or one-shot to register the passing of a pulse. That was about as elaborate as most logic probes got — simple and unpretentious, but still very handy for basic troubleshooting in digital circuits.

I still have a couple of these traditional logic probes in the drawer under my bench. But after trying out HP's new LogicDart they're never going to seem the same again...

Of course, the only real shortcoming of those traditional probes is that they're *only* logic probes. If you want to check a board's supply rails properly, you still need a DMM; it's the same if you want to check track continuity or the value of a pullup or timing resistor. And if you want to verify that the various clock signals are right, you still need to fire up the scope or the frequency counter. As for wanting to compare the relative timing of a couple of signals against the relevant clock — that's when you'll probably need a logic analyser.

Wouldn't it be great if somebody was able to come up with a single instrument capable of doing all of these jobs? They have, and it is; because that's just what HP *has* achieved with the LogicDart (HP E2310A).

When you first turn the LogicDart on after replacing the batteries, an 'about' display appears and describes the instrument as 'your personal digital troubleshooter'. To my mind that's a pretty apt description.

In fact it's a *very* impressive little beast. In a compact but rugged case only slightly larger than a typical DMM, HP's engineers have managed to squeeze the functions of a 3-1/2 digit digital voltmeter, an ohmmeter, a continuity/diode tester, a digital frequency counter, and a three-channel logic timing analyser with waveform storage and sampling up to 100MS/s. Oh, I almost forgot — there's also a built-in digital clock and calendar, and last but not least, a logic probe!

For DC voltage measurement the LogicDart operates over the range from -35V to +35V, with a rated accuracy of +/-(0.5% of reading + 2 counts) and a resolution of 10mV. For resistance measurement it measures from 0.01kΩ (10Ω) to 120kΩ, with essentially three digits of resolution and an accuracy ranging from +/-(1.5% of reading + 1 count) at the low end, to +/-(7.9% of reading + 1 count) above 12kΩ. The continuity LED and optional beeper operate below around 140Ω.

For frequency measurement, it operates over the range from 1Hz to 33MHz, with only one digit of readout below 10Hz, two between 10Hz and 99Hz, and three from 100Hz to 33MHz. The rated accuracy is +/-(0.1% of reading + 1 count).

As a logic probe, it has the usual high (1) and low (0) logic level LEDs, which are both off in the tri-state mode and in this case also flash alternately at a fixed rate if the LogicDart detects

a pulse train or other dynamic waveform. The high and low logic thresholds can be set up to correspond to TTL (3.3V CMOS), 5V CMOS, or ECL. The beeper can also be enabled if you wish, to provide two different audio tones for high and low (giving an alternating two-tone beep for a pulse train). Glitches of 15ns or greater duration can be detected.

Extending these functions as a logic analyser, the LogicDart can make use of two further input channels in addition to the main 'Channel 1' input used for the functions just described. It therefore becomes a three-channel logic timing analyser, sampling at up to 100MS/s and taking records of 2048 samples per channel. There's a choice of edge, pattern or edge/pattern combination triggering, and the effective timebase range can be set between 10ns/div to 20s/div.

In this mode there are two cursors which can be manipulated for relative timing measurements, quite apart from the LogicDart's own ability to make an automatic frequency measurement. As with many modern DSOs and logic analysers there's also one of those magic 'autoscale' buttons, where the

instrument automatically sets itself to give you at least a 'ballpark' display of whatever signal is present.

As an analyser you can operate the LogicDart in either single or continuous sampling mode. You can also save and recall waveforms, and compare a new waveform with one previously saved. And — wait for it — you can even print out measurements and waveforms on a small portable thermal printer, an optional accessory. The two are coupled via an infra-red link rather than a cable.

Micro controlled

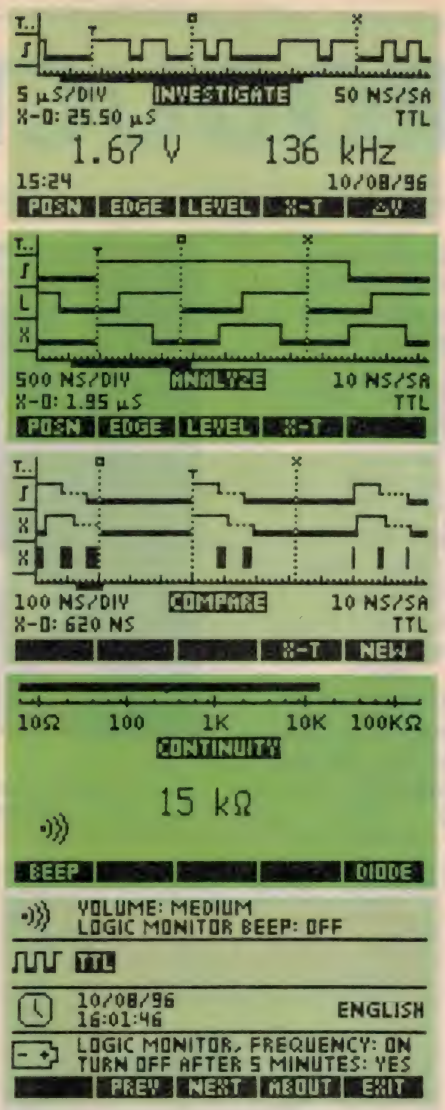
Needless to say these impressive LogicDart goodies are under the control of a microprocessor, as with most modern test instruments. Despite this it all runs on either three AA alkaline cells, or a plug-pack power supply (included) delivering 12V DC. Typically it will operate for about 15 - 20 hours from a set of batteries.

The case measures 198 x 89 x 38mm, and weighs only 400g. At the top of the case front is a rectangular LCD screen measuring 66 x 37mm, and with an active area of about 61 x 33mm. This is used for most of the LogicDart's information display, apart from the three LEDs at the bottom used for the logic probe and continuity indication.

The LCD display appears to be fully bit-mapped, and of about 128 x 64 pixels; it's configured to show both graphical and alphanumeric information, in various combinations according to the mode you're in at the time. Although the waveform displays given are nominally only of the 'logic analyser' type, they do provide some indication of intermediate levels — and hence a useful guide to waveform integrity.

The five buttons visible immediately below the display in a horizontal row are software-defined function keys, with their functions always clearly defined along the lowest area of the display. Below these again are the LogicDart's 17 other control buttons, arranged as you can see in a fairly intuitive series of groupings. The main on/off button is at top left, in a row with the three mode select buttons; then there's an array of nine buttons used for things like cursor control, timebase range select, shift select and waveform saving/recall. Down at the bottom are the buttons used for acquisition control, and finally the 'System' button used to set the LogicDart's clock/calendar, logic thresholds, display language (there's a choice of six), beep options and so on.

If you haven't noticed from the picture there's also a 'Help' button, which produces brief but handy displays of



Some of the LogicDart's display modes. From the top are the Investigate, Analyse, Compare and continuity modes, and finally the system setup screen.

information on mode options and the functions of the various keys. This makes the LogicDart's user manual largely redundant after you've looked through it initially.

I should also mention at this point that the LogicDart comes with various accessories, as well as the manual and AC adaptor. There's a zip-up soft carrying bag plus three probe leads with a set of 'attachments' including two 'browser' probe bodies with fine sharp points, six miniature 'grabber' clips, three adaptor tips, and some ground leads and extender pins.

Trying one out

Thanks to our good friends at H-P Australia's TMO division, we were able to get our hands on one of the first LogicDarts into the country, and I was able to try it out for a while. I tried to give it quite a workout, by using it to check signals in a number of different boards (including the final prototype of my PC-driven Arb & Function Generator).

Frankly, I was most impressed. The LogicDart really does seem to include pretty well all of the functions you need for a lot of day-to-day troubleshooting in digital circuitry, all rolled into one handy and easy to drive little instrument. Instead of having to reach for and/or turn on a variety of other instruments, to check out various possibilities, most of the time you merely need to press a few buttons on the LogicDart...

My best summary of the instrument is that it's essentially the 'digital-domain multimeter' many of us have needed for years, but probably didn't ask for because we didn't think it could be done. HP's designers have my vote, not just for seeing the need, but also for working out how to deliver the solution — and at the price they've achieved it.

By the way regular readers won't be surprised to learn that while I had the LogicDart, I carefully opened it up to have a look around inside that compact case. And the interior turned out to be just as impressive as its external functions. The LogicDart is very nicely made, and clearly designed for both efficient automated assembly and convenient later servicing if needed.

So that's about it. For anyone who does design and/or troubleshooting of digital circuitry, you really only have to try out the LogicDart to want one. Your only problem is likely to be stopping your colleagues from borrowing it all the time! ❖

HP E2310A LogicDart

An advanced logic probe or 'personal digital troubleshooter'. Combines a logic probe, 3-1/2 digit DC voltmeter/ohm meter, diode/continuity tester, 33MHz frequency counter and three channel 100MS/s logic timing analyser in a compact case, with microprocessor control.

Good points: Provides just about all of the test functions needed for efficient troubleshooting in the digital domain, in a handy and easy to use form.

Bad points: If there are any, we couldn't find 'em. It might need a secure point to attach a chain, to prevent it 'wandering'.

Australian Price: $1130 plus sales tax if applicable. The optional HP 82240B portable thermal printer is $205.00 plus sales tax.

Available: By calling HP Australia's Call Centre on 1800 629485.

NEW PRODUCTS

1GHz scopes for communications

Tektronix has announced the TDS 700C and TDS 500C family of InstaVu digital storage oscilloscopes (DSOs). The new models are said to be optimised with a new and unique communications signal analyser package and other enhancements that allow designs to be verified with a wide variety of industry standards. They allow direct connection of optical and electrical communication signals and the extended triggering modes are claimed to enable better efficiency when capturing communication signals.

The instruments are available in four and two channel models and have a real-time sampling rate up to four gigasamples per second, a waveform capture rate up to 400,000 acquisitions per second, an 8MB record length, and a 1GHz bandwidth. There are five models in the series, three with colour displays and two with monochrome displays. Prices start at US$14,592 (TDS 700C) and US$10,705 (TDS 520C).

For further information circle 242 on the reader service coupon or contact Tektronix, Test and Measurement Products, 80 Waterloo Road, North Ryde 2113; phone (02) 9888 0100.

IR remote control via a radio link

The Powerlink system lets you control infrared remote controlled audio visual equipment anywhere in the home. The system includes a relay unit, a base unit, two power supply units and instructions. The relay unit is placed in the room where control is needed, and the base unit in the room with the equipment being controlled.

The relay unit senses the output of the equipment's IR remote control and relays the code as a radio signal. The original code is converted back to infrared by the base unit. The effective range of the system is claimed to be typically 50 metres. Additional base and relay units are available to expand the system. Extension infrared emitters are also available to give increased flexibility for positioning the base unit. The RRP of the Powerlink system is £59.99, additional base or relay unit is £29.99 and the extension IR emitter is £10. International delivery is available.

For further information circle 244 on the reader service form or contact Nationwide Antenna Systems, 17 Campbell St., Bowen Hills 4006; phone (07) 3252 2947.

SMD infrared rework tool

The Solder Light from PDR is a focussed infrared hand-held SMD rework tool, claimed to allow safe and easy removal of all SMD components. The process incorporates gentle preheating of the board to be reworked, with the Solder Light IR emitter providing the extra heat energy to the component being removed. This causes the solder joint to reflow, allowing the component to be removed.

The system allows SMDs with connection points under the body of the component to be safely removed, as the heat to reflow the solder does not have to be driven through the device. Instead, reflow occurs at the junction of the two sources of heat energy. The balanced application of heat energy also allows rework of components with heat sensitive parts, including SMD connectors which can melt with conventional techniques.

The controlled heat profile is said to be safe and repeatable, preventing damage to the reworked component, surrounding devices or the PCB. It also avoids the situation where a hot gas tool can blow away light components positioned close to a heavy component being reworked.

For further information circle 247 on the reader service coupon or contact Computronics Corporation, 6 Sarich Way, Technology Park, Bentley 6102; phone (08) 9470 1177.

Virtual DSO, spectrum analyser and DMM

The Pico ADC 200 is a high speed virtual instrument for use with a PC. Together with PicoScope Software, it allows a computer to be used as a 50MS/s dual channel digital storage oscilloscope (DSO), a spectrum analyser or multimeter. The external trigger connector also doubles up as a simple signal generator.

The device plugs into the parallel port of the PC and is controlled via Windows (3.x or 95). It allows a signal to be viewed as a waveform, while simultaneously showing frequency components of the waveform (like a spectrum analyser) and AC voltage and frequency values.

The ADC 200 can also be used as a high speed data acquisition/data logging device. Drivers written in C, Pascal and Windows (Visual Basic, Delphi and Excel) are supplied with the instrument. It comes in two versions: the ADC 200-50 capable to 50MS/s samples and spectrum analysis to 25MHz, and a lower cost unit with 20MS/s and spectrum analysis to 10MHz. Both units are supplied with cables, power supply and manuals.

For further information circle 243 on the reader service coupon or contact Emona Instruments, PO Box 15, Camperdown 2050; phone (02) 9519 3933.

Radio operated controller

Imark Communications has developed a radio controlled relay switching system which operates in conjunction with normal mobile and/or portable radios that are fitted with a DTMF encoder. The controller comprises a KG208 mobile radio, a power supply, an Imark D104 four-way DTMF decoder and an interposing relay module, and is housed in a weather resistant enclosure. The system can be supplied to operate on any RF frequency between 66 and 520MHz.

Up to four DTMF decoders can be installed to control four different functions. The decoders can be link-selected to provide N/O or N/C contacts and the outputs can be isolated for servicing. Applications include controlling lights; security gates and doors; irrigation systems; equipment in plants, factories, or at mine sites.

For further information circle 241 on the reader service coupon or contact Imark Communications P/L, Unit 2, 75 Mark Street, North Melbourne 3051; phone (03) 9329 5433. ❖

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READER INFO NO.31

Microprocessors and Peripherals

Faster 80C51 MCUs take less power

Philips has introduced a new range of 80C51 and derivative microcontrollers (MCUs) said to feature a 50% increase in speed and up to 75% reductions in power consumption compared to existing 80C51 devices. The devices have a 2.7V to 5.5V operating voltage range, and are suitable for battery-powered applications such as pagers, PCMCIA cards and mobile phones.

The redesigned 80C51 core has allowed an increase in the maximum clock frequency from 24MHz to 33MHz, and makes the chips fully static in operation. As a result, the system clock can be stopped to reduce standby power consumption without losing the contents of registers or affecting the state of the microcontroller.

The first members of the redesigned 80C51 family are now available in masked ROM form. Philips' entire family of 80C51 microcontrollers will migrate to the new core design by the end of 1997.

For further information circle 201 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 9805 4479. Internet at **http://www.semicondutors.philips.com**.

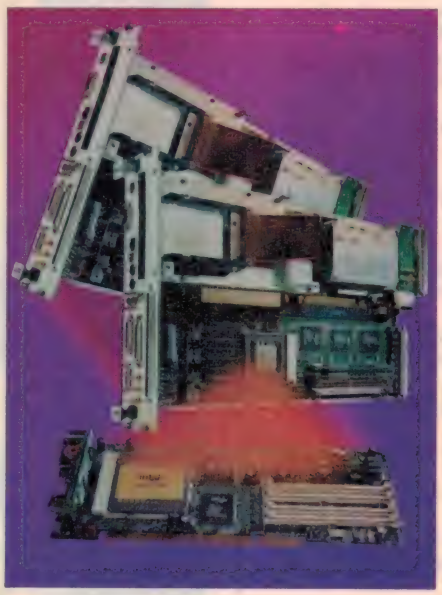
Embedded VXI controller uses Pentium Pro

National Instruments has announced the VXIpc-860 embedded VXI controller, said to be the first with a 200MHz Pentium Pro processor. It is 35% faster than the company's 200MHz Pentium VXIpc-850, and compatible with Windows NT/95/3.1. It is also VXI plug-n-play compliant, and compatible with the company's LabVIEW and LabWindows/CVI application software, test executive software, and NI-VXI/VISA bus interface software.

Like all of the VXIpc-800 series, the controller features a modular, PCI-based local bus design with an interchangeable daughterboard to upgrade to new microprocessors. It has the MITE, MANTIS, and TNT4882C custom ASICs, and can achieve a VXI data transfer rate better than 30Mb/s.

Also included are 16MB of DRAM (upgradeable to 128MB) and a 1.3GB (or larger) internal, enhanced IDE hard disk. The front panel has connectors for a super VGA monitor, a GPIB interface, serial and parallel ports, SCSI-2, and 10-Base-T Ethernet. Also on the front panel are two PCMCIA slots (one Type II and one Type III), a single full-size expansion slot that accepts either a PCI or an ISA plug-in board, VXI clock and trigger signals, and an internal floppy drive.

For further information circle 207 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 9879 5166. Website at **http://www.natinst.com/.**



Eurocard PC with PAL/NSTC Video

The PC-EYE is an embeddable PC card with built-in video capture. It allows composite video or S-video format PAL/NSTC sources to be processed for live video display on Windows-based systems. It is built around the EC586 high performance PC sub-system, and the EC586TV mezzanine module.

Images can be acquired from camera, VCR, or other PAL/NSTC sources and displayed to screen on a resizable window within a Windows-based system. Live video functions can be added to suit client applications.

The EC586 is a Pentium PC on a single 100 x 160mm Eurocard and has all the features and functions normally found in a complete PC. It can often be used as a stand-alone single board computer and has both PC/104 and IEEE1000 interfaces for expansion with industry standard modules.

For further information circle 208 on the reader service coupon or contact DGE Systems Pty Ltd, 103 Broadmeadow Road Broadmeadow, 2292; phone 1800 818 736.

16K and 32K Serial EEPROMs

Atmel Corporation has announced the availability of the AT24C128 and AT24C256, a pair of ultra-high density, two-wire serial EEPROM devices specifically developed for the cellular phone market. The devices are organized as 16,384 (16K) and 32,768 (32K) x 8-bits respectively. In cellular phones, these devices are used to store frequently dialled numbers, last number called and other memory-based functions.

Additional applications include high end TV chassis, pagers, set-top boxes, digital cameras, and other portable consumer applications.

The devices are available in 1.8V, 2.7V and 5V versions, and support clock frequencies up to 1MHz. They are currently being offered in 8-pin JEDEC PDIP and 8-pin EIAJ SOIC packages and are plug-in replacements for previous generation lower density Atmel devices. The new devices are also being offered in the new chip array BGA package.

For further information circle 210 on the reader service coupon or contact Atmel Corporation, 2325 Orchard Parkway, San Jose, CA 95131; phone (408) 441 0311, Web site at **http://www.atmel.com**.

USB-based micros

Motorola has announced the first of a family of universal serial bus (USB) 8-bit microcontrollers, the 68HC(7)05JB2 and 68HC05JB2 which are aimed at low-speed USB computer mouse applications.

The 68HC(7)O5JB2 has an on-chip memory of 2048 bytes of user ROM (or EPROM) and 128 bytes of user RAM. It also has 16-bit input capture/output compare timers, 10 bidirectional I/O pins, a low voltage reset (LVR) circuit, a 3.3V +/- 10% DC voltage for the USB pull-up resistor, and hardware mask and flag for external interrupts. It provides fully static operation with no minimum clock speed, multifunction timer, power saving STOP and WAIT modes, illegal address reset and an 8 x 8 unsigned multiply instruction.

Mask options for the 68HC05JB2 include external interrupt pins, edge triggered or edge and level triggered; port A and port B pulldown and pull-up resistors connected or disconnected; port A PAO-PA3 external interrupt capability enabled or disabled.

For further information circle 209 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 9887 0711.❖

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READER INFO NO.34

PLC review:

THE SPLAT SL88 MICROCONTROLLER

Programmable logic controllers can be put to use in a vast range of applications, from home security to home automation; from running lights, to running a bottle factory. The SL88 from Victorian firm Microconsultants is aimed more at hobbyists and people needing to control small machinery at a low cost — and what's more, it's designed and built in Australia.

by GRAHAM CATTLEY

If you have ever tangled with a programmable logic controller (PLC), you'll know that at best they tend to be frustrating, lumbering beasts that take months of experience to program effectively. You'll also know that most of them use a rather antiquated programming system known as a 'ladder diagram'. These diagrams attempt to represent the program structure as though the PLC were made up from a series of interconnected relays.

This is perhaps because early PLCs *were* a series of interconnected relays. Great racks of them, in fact. Any major changes to an existing program were done with an angle grinder, a box of new relays, and several miles of wire.

Needless to say, the microprocessor revolution changed all this, and you can now see an entire factory controlled by a small box on the wall. Unfortunately, many modern PLC systems inherited the programming techniques of their prehistoric ancestors, mainly for backward compatibility. Another feature that's been preserved is the price: today you're likely to be up for $1000 or so, even for a bare-bones system.

The SL88

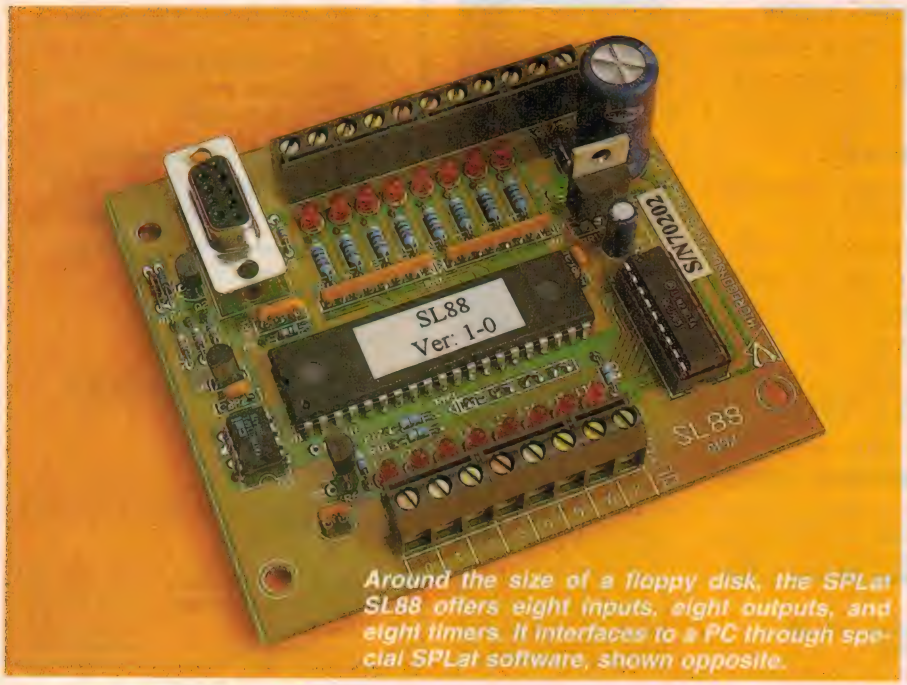
The SPLat SL88 is a simple, straightforward microcontroller made in Australia by Microconsultants, an Australian company which realised that what the world really needed was a simple, off-the-peg microcontroller unit that could be used by anyone needing to control a small to medium system.

The SL88 differs from most other PLCs systems in three important areas: simplicity, ease of use, and price. The SL88 costs around $150.00, consists of a single high quality PC board measuring just 88 x 95mm (the size of a floppy disk), and yet provides the following features:

- Eight inputs;
- Eight outputs;
- Four timers timing over the range of 100ms to 0.9 hours;
- Another four timers timing from 10ms to 5 seconds;
- 24 data memories;
- 500 program steps;
- an RS-232C interface for downloading programs from a PC, and
- LED indicators on all inputs and outputs.

A built-in regulated supply running off 24V DC (or 18V AC) powers the controller, and all off-board connections are made by screw terminals. Each output is rated at 400mA, with the controller able to support a total output current of 1A.

As you can see from the photo, there is relatively little on the board, with almost all the work done by the large 68HC705 microcontroller IC in the centre. The PC mounted DB9 socket allows you to plug the controller into a standard COM port on your PC for programming the controller's internal EEPROM, while the 17 LEDs indicate the status of the inputs and outputs, as well as power.



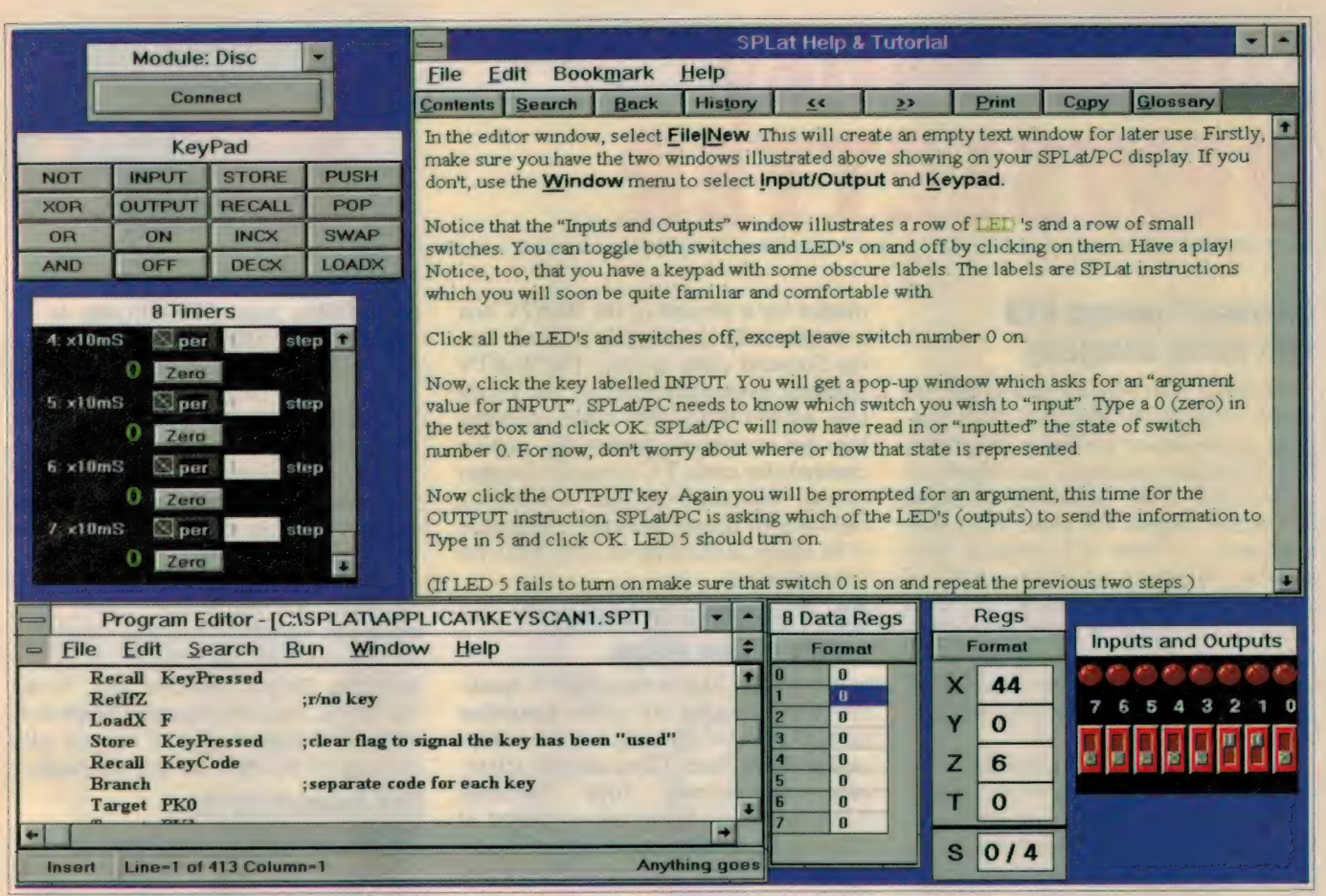
Around the size of a floppy disk, the SPLat SL88 offers eight inputs, eight outputs, and eight timers. It interfaces to a PC through special SPLat software, shown opposite.

SPLat/PC software

The SPLat SL88 package consists of the SPLat SL88 board and a single floppy disk containing the SPLat/PC software and support files. That's it — no thousand page manuals or user guides to digest. The whole basis of the SPLat system is that you can get the thing up and running in a matter of minutes.

The SPLat/PC software supplied is designed to perform two main tasks: first, to let you write your program and download it into the SL88; and second, to perform an emulation of the microcontroller so that you can test your program *in situ*.

This latter function is perhaps the most interesting and enjoyable part of



working with the SPLat/PC system, in that you can make real time changes to your code and see the results immediately. There's no need to go through the cumbersome edit-save-compile-download-run routine every time you want to make any changes.

The SPLat/PC program consists of a number of different windows, each displaying a different aspect of the microcontroller's operation. One of the most interesting of these is the input/output window, which shows a block of eight DIP switches and a row of eight LEDs. The switches are effectively connected to the controller's eight inputs, and can be turned on or off by clicking on them with the mouse. The output from your program is displayed on the row of LEDs, which change colour when they turn on.

All this happens in real time, so you can get a pretty good idea of how your program will behave in the real world. Other windows show the status of the stack (a temporary storage system), a listing of the values of any used variables, and the status of the eight built-in timers.

SPLat/PC appears to be well written, with much attention to detail, and a sensible layout. A couple of the nicer touches include the ability to view stack values in hex, boolean, or decimal notation, and automatic scaling of timer values to compensate for running the program in the emulator.

The actual programing language is a sort of cross between BASIC and assembler, with reverse-Polish stack based arithmetic operations. All very well, you say, but what good is all this if you've never been able to program the VCR, let alone a PLC — besides, wasn't I raving on at the start of the article about how difficult PLCs are to program?

Well, yes I was, but there is one aspect of SPLat/PC that I haven't mentioned yet — the help and tutorial file. This file is marvelous. Displayed in Windows Help file format, it walks you through the whole system in a graduated series of experiments that can be performed quickly and easily.

Even if you can't drive a programmable calculator, you'll have no problem working through each of the demonstrations, each of which introduce a different aspect of programming PLCs. It is aimed very much at people who haven't programmed before, and with the advantage of running each of the programs on the emulator, single-stepping and changing inputs on the fly are easy and simple to do.

If you have a real SL88 plugged into the serial port, its outputs will mirror what's happening on the screen — very handy for testing in a real system, and very encouraging for new users who can see that their program actually *does* something.

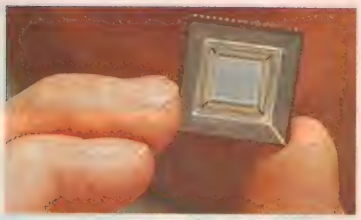
The tutorial covers more that just programming, however. It goes into control systems and concepts, and in later stages it covers state machines and state diagrams.

So, if you are looking at a simple way to control a sprinkler system, stage lighting or even a large model railway, consider using the SL88 programmable logic controller; it's cheap, simple, easy to program and Australian made. What more could you ask? ❖

SPLat SL88

Good points: Cheap enough to use in most applications, terrific help file, program editor includes SL88 emulator.
Bad points: Inputs and outputs are not electrically isolated.
RRP: Around $150.00.
Available: Should soon be available from most major electrical/electronics suppliers, or contact Microconsultants directly at 2/12 Peninsula Blvd, Seaford, Vic. 3198. Phone (03)9773 5082; web site **http://www.microconsultants.com**, where you can download a free copy of SPLat/PC.

Silicon Valley NEWSLETTER



Microsoft pumps $1B into cable company

Impatient with what he sees as the low speed with which television and computer technologies are being integrated, Bill Gates has announced that Microsoft is investing US$1 billion in Comcast, the fourth largest US cable television company — with 4.3 million subscribers. Microsoft will own 11.9% of Comcast. Most importantly, the deal will put Microsoft in position to force Internet integration into the television industry, which has been reluctant to succumb to the wild and wacky world of the Internet.

Gates said that he and Comcast president Brian Roberts will work closely together regarding the direction of Comcast. Microsoft treasurer Greg Maffei will serve as an observer on Comcast's board of directors.

Driving the deal is Microsoft's belief that its current dominant position in the personal computer software industry has created a unique, but time-limited window of opportunity to control the future direction of the Internet into the consumer market through television.

"This move is geared towards Microsoft casting itself as a massive information company for the next century", said Stephen Auditore, president of Zona Research, a television industry market research firm. "By investing in Comcast, they are essentially going to get themselves something of a captive delivery mechanism for content."

The first to benefit from the Comcast investment will be WebTV, the San Francisco company that is marketing set-top boxes which allow TV viewers to surf the Internet. WebTV's progress in the market has been hurt by the slow pace at which telephone and television companies are updating their equipment to handle Internet traffic.

Comcast will use much of the $1 billion from Microsoft to accelerate the construction of fibre-optic cable to expand high-speed Internet access. Comcast is currently testing modems that would hook people's computers to the Internet via cable.

Gates said Microsoft will have a ready market for a version of the WebTV box it is currently developing to hook into the Comcast cable system. The WebTV software eventually may be put inside new set-top boxes that cable operators buy for customers, potentially putting channels for cable TV alongside Internet access. Microsoft is also developing software to enable personal computers to be easily hooked up to cable lines for Internet access.

S3, Faroudja to make super video chips

Would you like to have HDTV-quality video images on your computer screen? A new alliance between chipmaker S3 in Santa Clara and the television engineering firm Faroudja Laboratories in Sunnyvale is aimed at developing a set of chips that will provide PC displays with unmatched video display capabilities.

The two firms said they hope to have a prototype circuit board ready by the end of this year. The circuits to be designed will eliminate the distortions that typically occur when moving images from material developed for television broadcasting are played back on PC screens.

S3 is a US$460 million manufacturer of multimedia accelerator chips which are used, among others, by nine of the world's top ten PC manufacturers. Faroudja Labs is one of the world's leading television engineering firms, with numerous inventions found in a majority of TV sets on the market today — including Sony's Trinitron sets. In the late 1980s, Faroudja developed high-definition TV technology that worked with existing NTSC transmission standards.

IDT launches its 200MHz MMX processor

It works just like a 200MHz MMX processor from Intel, but the new IDT-C6 microprocessor launched by Integrated Device Technology (IDT)

An engineer at Sandia National Labs in New Mexico checks connections in one of the 86 cabinets of the new Intel-supplied parallel supercomputer, which has just achieved an incredible performance of 1.34 teraFLOPS (million-million floating-point operations per second). The computer uses some 9200 200MHz Pentium Pro processors, has no less than 573GB of system memory and a staggering 2.25TB (terabytes) of disk storage. (Courtesy Businesswire)

costs hundreds of dollars less than the Intel chip and could bring PC prices down below US$1000.

That is exactly the market IDT is aiming for and Glenn Henry, president of Centaur Technology, the Texas-based IDT subsidiary that developed the C6 for IDT, says that market will become huge in the next decade. The IDT-C6 will sell for around US$100 per chip, compared to around $450 which Intel charges for a comparable MMX Pentium.

Henry said he doesn't expect to be running into Intel in the market. "We're not taking on Intel. We're focusing on a part of the marketplace that's underserved by the other players", Henry said, adding that the PC microprocessor market is large and profitable enough for several more players to operate effectively without having to engage in cutthroat competition.

IDT is best known as a manufacturer of high-performance SRAM memories and other specialty circuits. The company clearly leveraged its chip manufacturing expertise in developing the C6, which contains 5.4 million transistors on a die measuring just 88mm^2 — about half the size of a similar Pentium. The chip is produced on a 0.35um line using a four-layer-metal CMOS process.

And Cyrix makes four...

Cyrix, the Texas chipmaker, has become the fourth company to offer PC manufacturers a family of medium to high-end MMX-capable microprocessors to run Windows-based operating systems and applications. The company's new 6x86MX processors run at 166MHz, 200MHz and 233MHz, and cost about half of what market leader Intel charges for similar products. Earlier Advanced Micro Devices and upstart Integrated Device Technology launched Pentium II-class processors.

At US$320, the Cyrix 233MHz processor compares with $469 that AMD charges for its comparable K6, while Intel has put a $583 price tag on Pentium II chips in this class. Industry analysts said Intel's price structure has only one way to go in the face of the new competition — and that is down, way down. "I think Intel will bomb their prices", said analyst Jim Poyner.

Intel's next round of scheduled price reductions wasn't until August. But analysts were expecting that Intel's system of regularly scheduled price cuts would be an early victim of the unprecedented competitive situation Intel is facing in the processor market, which it virtually had to itself until two months ago.

Cyrix said one of its first customers for the new line is CyberMax Computer, which will be marketing a line of Cyrix-based PCs ranging from US$1900 to $2300. Comparable Intel-based systems cost around $3000.

Sun breaks ban on encryption exports

Sun Microsystems has begun to market an advanced computer data encryption technology to customers worldwide, in defiance of US government policies that prohibit American companies from selling such software to overseas customers. Sun said it will be able to sell the software legally, because it was developed by the company's Russian-based subsidiary, Elvis. There are currently no laws against US companies selling encryption products that were developed outside the United States.

Sun said its encryption software is far more sophisticated than anything US companies are currently allowed to export.

Executives at RSA Data Security, the Silicon Valley company that pioneered the public-key type of encryption technology in the 1970s, said the Sun move could mean the beginning of the end for the US ban on encryption export controls. "This is a significant part of the wall coming down. That sound you're hearing is the dying gasp of a Cold War dinosaur", said RSA president John Bidzos.

Industry officials have been negotiating with the federal government for more than a decade for relaxation of encryption export controls, in the face of the availability of such products in overseas markets from local developers. To date, the US government has maintained it will only allow for encryption exports if the products incorporate code that national security and federal law enforcement agencies would be able to crack.

At Sun, executives tried to downplay the notion that their company was out to force the inevitable. "I want to emphasize that we had no intention of politicizing this. This development has come out of market demand. Our customers require this security, and we are giving it to them", said Humphrey Polanen, general manager of Sun's security and electronic commerce group.

Chip veteran to head SIA

George Scalise, a long-time semiconductor industry veteran and architect of the first US-Japanese chip trade agreement in 1986, has been elected to become the new president of the Silicon Valley-based Semiconductor Industry Association. Scalise, who is 63 and was a vice president at Apple Computer, succeeds Thomas Armstrong who left the association in March.

Scalise joined Apple last spring to help the company's then freshly-appointed CEO Gil Amelio turn around the struggling computer maker. Scalise followed Amelio from National Semiconductor. He spent a large part of his career at Advanced Micro Devices in Sunnyvale and Fairchild Semiconductor.

CMOS processors in new IBM mainframes

Mainframe computers are far from dead. To prove the point, IBM has released the fourth generation of its top-of-the-line 390 Series mainframes, machines that offer more bang for the buck plus vastly improved data security and user friendliness.

The new System 390 mainframes run on CMOS-based microprocessors, as opposed to the traditional custom circuit boards. Their low power consumption has eliminated complex and costly water cooling systems, allowing IBM to deliver machines that cost much less than the previous generation 390s, yet offer similar performance.

IBM said it expects a large portion of its current mainframe customer base to upgrade to the new machines, which are far less costly to operate and maintain. The company also expects the machines to do well in the market for corporate network servers and Internet access systems.

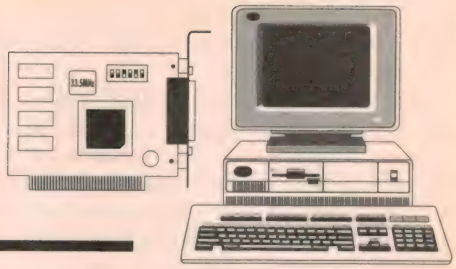
Barrett becomes Intel president

Craig Barrett, fondly referred to within his company as 'Mr Intel Inside', has been promoted to the position of president — replacing Andy Grove, who has become chairman. Grove retains his title of chief executive officer.

The new line-up more closely reflect the roles both men have been playing. Grove manages Intel's overall operations and interfaces with the outside world, while Barrett, as chief operating officer, has been making sure Intel's internal operation continue to run incredibly smoothly and profitably.

Many inside and outside of Intel credit Barrett for much of Intel's success. "Craig Barrett has got to be one of the most powerful unknown people in the industry", said Linley Gwenap, editor of *Microprocessor Report* newsletter. ❖

Computer News and New Products



Cordless keyboard with touchpad

The VersaPoint from Interlink Electronics is a cordless keyboard with a touchpad pointing device. The keyboard has 79 keys and a rectangular touchpad located below the space bar, with two mouse buttons immediately below. The VersaPad touchpad operates as a standard two-button mouse, with pointing accomplished either by finger pressure or the supplied stylus. Software drivers are included for Windows 3.x, Windows for Workgroups and Windows 95. The touchpad is claimed to provide precise cursor control.

The unit uses a broad beam infrared link to communicate to a discrete receiver that plugs into the computer. Connectors include a PS/2 plug with serial port adaptor for the touchpad, a mini DIN plug for the keyboard and an adaptor to full size DIN for traditional desktop machines. Up to four units can operate simultaneously in the same vicinity by selecting different channels. The keyboard is battery powered with four AA alkaline batteries and has a sleep mode that gives a typical battery life of one year. It has an RRP of $229.

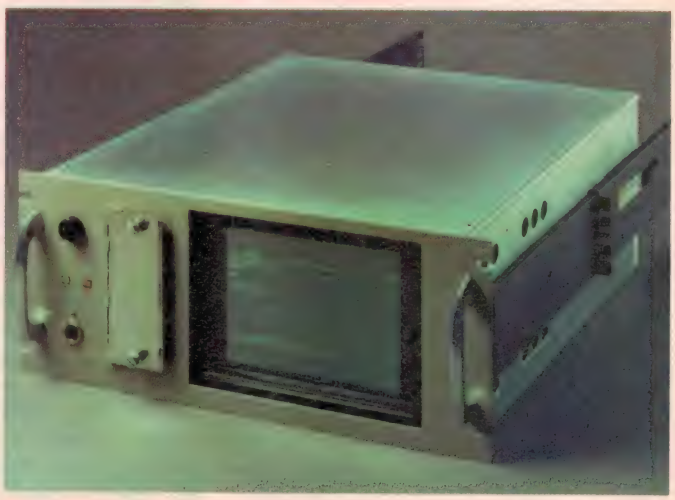
For further information circle 161 on the reader service coupon or contact BJE Enterprises, 124 Rowe Street, Eastwood 2122; phone (02) 9858 5611. Internet at **http://www.interlinkelec.com.**

Computer for hostile environments

Lucas Control Systems has introduced the Deeco ST-x 130 486 Pentium-based computer for rack-mounted applications. It is designed for use in hostile environments such as extreme factory temperatures and conditions of high humidity, shock and vibration.

The computer is claimed to be 100% compatible with IMB PC/AT software, and is available in SX to DX4 (100MHz) versions. An optional Pentium Overdrive processor is also available. All versions have two 72-pin SIMM sockets for up to 64MB of DRAM. It has a 213mm Sharp colour LCD display (640 x 480 pixels) with optional SealTouch infrared (IR) touch controller, which eliminates the need for a keyboard. A standard keyboard or mouse can also be used.

The computer includes three full-size and one half-size ISA card slots, shock-mounted internal hard drives, and a 3.5" 1.44MB floppy disk drive. Local bus Ethernet and a 1.5MB semiconductor disk are available as options. It comes with one RS-232C serial port, one parallel port and a keyboard port, and has an internal 32-bit VESA local bus.



For further information contact Lucas Control Systems Products, Wendlingen, Germany; phone +49 7024 971 214, fax +49 7024 971 240.

266MHz Pentium II PC

Hewlett-Packard has announced a new HP Vectra VL PC powered by Pentium II 233MHz and 266MHz processors. Prices will be announced soon. The computer features a 'tool-less' desktop chassis, claimed to make it easier to service, maintain and expand. For example, a CD-ROM or other 5.25" front shelf device slides into the chassis without screws or rails, and the back-shelf expansion is held with one screw secured without tools.

The computer can also can function vertically or horizontally and has a modular internal design that allows the motherboard and backplane to slide out of the chassis, without removing add-on cards or disrupting other components. It will include a 24X CD-ROM (on selected models), two USB (universal serial bus) ports and up to 4GB of IDE hard-drive capacity.

For further information phone the HP Customer Information Centre on 131347. Their web page is at **http://www.hp.com**.

Low cost HP 600dpi laser printer

Hewlett-Packard has introduced the HP LaserJet 6L printer as a replacement for the company's 5L printer, with an expected street price of $799 (including sales tax). Print speed is six pages per minute, a 50% increase over its predecessor, and the duty cycle is increased from 4000 to 6000 pages per month. It also has 'instant on' fuser technology to eliminate warm-up time.

The printer has 600 x 600dpi resolution, resolution enhancement for graphics and text, and comes with a choice of 26 TrueType scaleable typefaces. It has 100-page input and output trays, a single sheet feeder and a straight-through paper path said to ensure wrinkle free printing of envelopes, labels, special stock and transparencies.

The printer comes with 1MB of memory, effectively doubled with HP's Memory Enhancement technology (MEt), and can be expanded to 9MB. Copy, fax, file and read capabilities can be added with the optional LaserJet Companion printer accessory.

For further information phone the HP Customer Information Centre on 131347. Their web page is at **http://www.hp.com**.

Updated software for schematics

Ivex Design International has released WinDraft Schematic Capture version 2.0. The program has several new features, such as a parts palette of up to 20 frequently used parts and the ability to import BMP graphic files. Truetype fonts have been added throughout, including title block, pin numbers, references, values, and hierarchical sheet symbols. Editing functions, toolbars and dialog boxes have been revised, and design size is now displayed on the tool bar.

Other new features include automatic cyclical backup, print preview, faster screen refresh, design statistics and on-screen pin count indicator. The unlimited pin capacity version is $868, and the 650 pin version is $442.40. Free shareware versions of this program and its companion Winboard PCB layout program can be obtained from **http://www.ivex.com**, http://www.midcoast.com.au/bus/me or by downloading 'wdshare.exe' and 'wbshare.exe' respectively on the anonymous FTP service. These versions are complete, fully functional programs with a 100 pin/pad limitation and can be used to view any size design.

For further information circle 163 on the reader service coupon or contact ME Technologies, PO Box 50, Dyers Crossing 2429; phone (065) 50 2200. Internet **http://www.midcoast.com.au/bus/me.**

Phone/fax modem runs at 50kb/s

The new Sportster Flash fax modem with personal voice mail from US Robotics combines voice mail, speaker phone and fax facilities. It is 'x2 56K' technology ready (for speeds of more than 50kb/s over normal telephone lines), and is Flash ROM upgradeable to future standards.

The modem digitally records incoming voice messages for multiple voice mailboxes, and can signal an alphanumeric pager when fax or phone messages arrive, for retrieval from a remote location. It also automatically detects an incoming fax call and has a full duplex speaker phone. Because it supports international data communication standards, the modem is compatible with the 33.6kb/s V.34 standard, and is also compatible with modems down to 300b/s. The RRP is $229.

For further information circle 160 on the reader service coupon or contact US Robotics Pty Ltd, 473-479 Victoria Street, West Melbourne, 3003; phone (03) 9482 6557.

SOFTWARE
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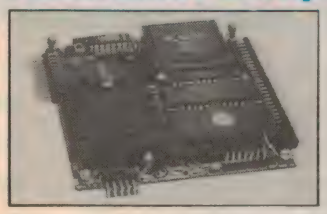
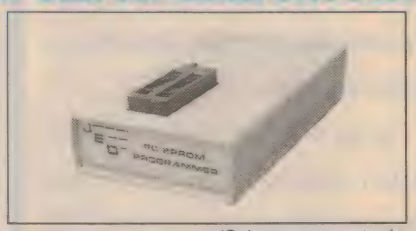
READER INFO NO.41

Australian Computers & Peripherals from JED... Call for data sheets.



Australia's own PC/104 computers.
The photo to the left shows the JED PC540 single board computer for embedded scientific and industrial applications. This 3.6" by 3.8" board uses Intel's 80C188EB processor. A second board, the PC541 has a V51 processor for full XT PC compatibility, with F/Disk, IDE & LPT. Each board has two serial ports (one RS485), a Xilinx gate array with lots of digital I/O, RTC, EEPROM. Program them with the $179 Pacific C. Both support ROMDOS in FLASH. **They cost $350 to $450 each.**
$130 PROM Eraser, complete with timer
$300 PC PROM Programmer.



(Sales tax exempt prices)
Need to programme PROMs from your PC?
This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb. It does it quickly without needing any plug in cards.
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Office 7, 5/7 Chandler Road, Boronia, Vic., 3155. Phone: (03)9 762 3588 Fax: (03)9 762 5499
READER INFO NO.35

CONGRATULATIONS TO ELECTRONICS AUSTRALIA ON ITS 75TH ANNIVERSARY.

GRIFFITH UNIVERSITY
INDUSTRIAL AFFILIATES PROGRAM
5TH ANNIVERSARY - JUNE 1997

From 1993 - 1997, 150 students have provided valuable solutions and working prototypes to 70 Queensland electronic industries.

The Industrial Affiliates Program, an Australian first, makes final year students available to organisations for three months. Students get involved in industry projects at the conceptual stage through to the completion of prototypes.

Industry projects are now being accepted for the next program.

Make sure you are part of this valuable program by accessing highly trained microelectronic engineering students and the extensive electronic resources of Griffith University.

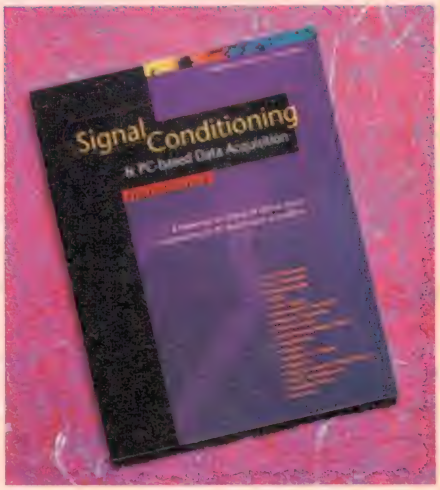
To tap into these resources, please contact Carol-joy Patrick on telephone (07) 3875 5007, facsimile (07) 3875 6726 or email: c.patrick@sct.gu.edu.au

GRIFFITH UNIVERSITY
LEADING THROUGH INNOVATION

LBC&M GU0622

READER INFO NO.36

Handbook on PC data acquisition



Iotech has published a 128-page *Signal Conditioning and PC-Based Data Acquisition Handbook*, claimed to be a definitive guide to signal conditioning techniques used in today's test and measurement applications. It is said to be a comprehensive reference tool that helps readers design accurate data acquisition applications, avoid common pitfalls, and understand the requirements needed for proper transducer use.

The handbook serves both as a primer for the beginner and as a quick reference guide for the experienced engineer.

For further information circle 164 on the reader service coupon or contact Scientific Devices Australia, PO Box 163, Oakleigh M.D.C. 3166; phone (03) 9579 3622.

ISDN tester for primary rate interface

Wandel & Goltermann has released its new IBT-20 universal tester for the ISDN primary rate interface (PRI). The instrument is said to include all the test functions needed to bring into service and maintain ISDN lines and ISDN equipment such as PBXs. It includes a tracer for TE and NT operation, and error rates (BERT) can be measured and services tested in both modes.

Other features include monitoring capabilities, X.25 test functions (B or D channel), a Windows PC detailed decoder for examining traces and captured data, and access to all results for printing logs.

For further information circle 166 on the reader service coupon or contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205; phone (03) 9690 6700. ❖

DRAKE

SHORT WAVE RECEIVERS

SW1. 100 kHz - 30 mHz AM, Desktop, Synthesised with 32 memories $620

SW2. 100 kHz - 30 mHz, AM & SSB, 100 memories, optional remote, Desktop $1020

SW8 Desktop or portable, 500 kHz - 30 mHZ, 87-108 & 118-137 mHz. 70 memories. $1670

R8A. Professional fully featured shortwave receiver.Software controllable. $2300

Timewave DSP noise filters, PK12 & PK96 data controllers, ACARS packages, all AEA software and accessories back in stock.

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http://hamradio.com.au

SUNSHINE DEVICE PROGRAMMERS

Power 100 - Universal Programmer 48 pin Textool Socket para I/F	$1,371
Hep 101 - Value for Money 8MB E(E)PROM - 1 slave socket	$283
Hep 808 High Speed 8 MB E(E) PROM programmer 1 master 8 slave sockets	$790
Jet 08 Production Series E(E)PROM Programmer Stand alone or PC (para)	$1,590
PEP01 Portable 8MB E(E) PROM series Programmer, Parallel Port	$295
EML2M EPROM Emulator	$480
Picker 20 Stand Alone IC Dram CMOS Portable Tester	$199
RU20IT 16 Piece UV EPROM Eraser with timer	$187

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READER INFO NO.38

WEBWATCH

presented by GRAHAM CATTLEY

The IBM Patent Server

http://patent.womplex.ibm.com/

The US patent server is an interactive search site containing over two million patents. This site contains information regarding US Patent & Trademark Office (USPTO) patents, and is designed to make searches of US patent information over the last 26 years. The server lets you search for patents by patent number or by performing a text search for each patent.

Once you have a list of patents that match your search results, you can view an abstract of each patent by simply clicking on it. If it looks interesting, you can then view an image of the actual patent submission, scanned in from the original.

There is provision to order the full text and any image of a patent in hardcopy, and this can either be faxed or mailed to you. If you find an especially interesting patent, you can vote for it and it may appear on their Gallery Page, along with patent #4858627 for a Smoker's Hat, or patent #5606804 for a Microwave clothes dryer and method with hazard detection...

VAF Research

http://www.vaf.com.au/

If you're in the market for a set of Australian-built hifi loudspeakers, just enjoy window-shopping for speakers, or are interested in the design philosophy and background history of a respected local loudspeaker designer, VAF's Research's new web site may be worth a look.

It offers high resolution images, technical details and prices for VAF's entire range of loudspeaker products, including those available in kit form, plus reprints and quotes from media reviews of several models. Not surprisingly, the site also offers internet facilities for ordering and finding out more about VAF speakers, plus a Technical Information page on hifi loudspeakers.

A rather interesting page of information is the history of VAF Research, covered in some detail by founder, designer and now Managing Director Philip Vafiadis. Here Philip recounts his early aspirations as a genuine speaker enthusiast and designer, and takes the story through to the present day with his thoughts on the future of VAF products..

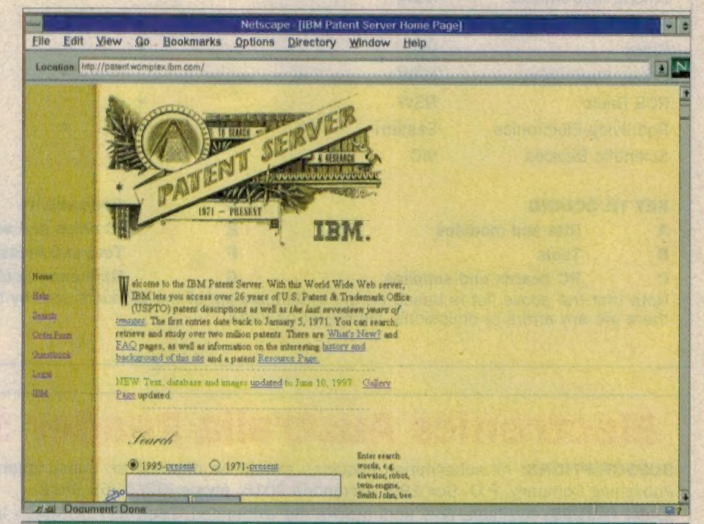
Fluke Corporation

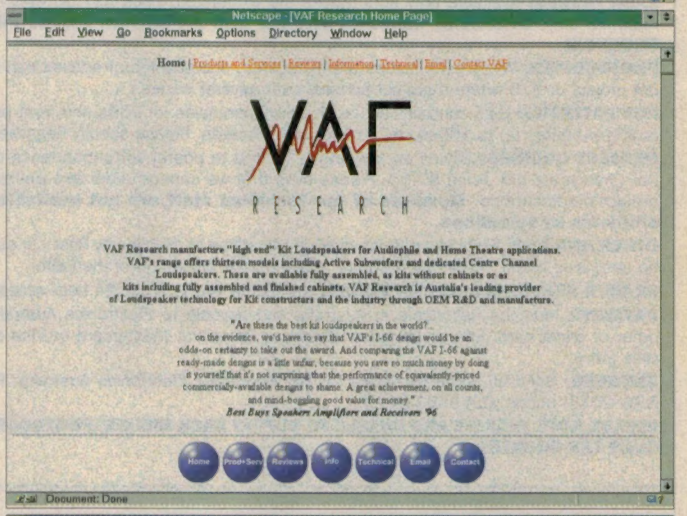
http://www.fluke.com/

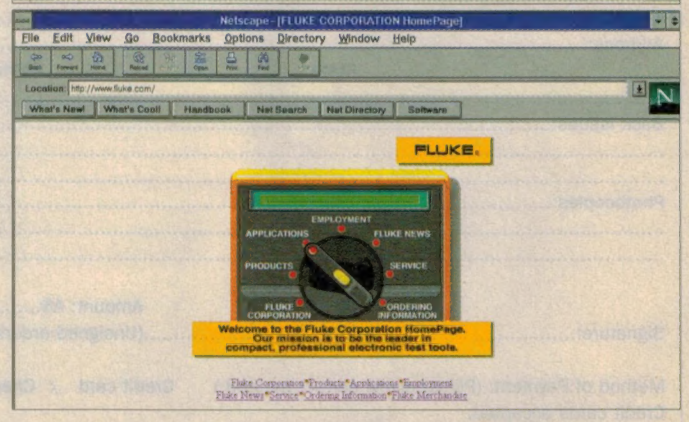
As you probably know, Fluke produce a wide range of electronic test equipment, from simple handheld digital multimeters through to high end calibrators. Their web page gives details of all the products in their range, along with basic specifications for their more popular test equipment.

If you dig far enough, you'll find a series of application notes on how to use Fluke equipment to perform a multitude of tasks. These notes range from component testing to power measurements, and they all seem to be quite clearly written with a healthy sprinkling of diagrams along the way.

There also seems to be a huge section of the site devoted to computer network analysis, containing chat rooms and other support services, but you'll have to register with Fluke if you want to take advantage of it. ❖







Have you come across any good sites that you think other readers would be interested in? If so, feel free to let us know — our email address is **electaus@magna.com.au**, so why not drop us a line?

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

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PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

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ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

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10A – 20A POWER SUPPLY

Make a 13.8V 10A (20A peak) DC power supply from recycled components! Includes transformer (350VA), mains lead, 100kuF electro capacitor, heatsink, new PCB with all on-board components and power transistors (No casing, wire or connectors.) Bargain price: **$80**

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New, Australian (Preslite) 12V DC golf buggy motor. Low speed-very high torque. 75mm dia, 150mm long, 30mm shaft with dia 7mm, weight 2kg. No load 4A, full load 10A: **$36**

20A DC MOTOR SPEED CONTROL

Ref SC June '97, slightly modified, PCB and on-board components (with 2 power MOSFETS!), plus the flyback diode and capacitor needed across the motor: **$18**

MAGNIFIERS / LOUPES

Jewellers eyepiece: **$3**, Twin lens loupes: 50mm **$8**, 75mm **$12**, 110mm **$15**. A set of 4: **$30.**

12V SLA BATTERY CHARGERS

Intelligent 13.8V / 650mA "plugpack" gel cel battery chargers. Has isolation transformer, electronic switching regulator, dual LED indicator: **$8.80**

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Slightly blemished high resolution US made night vision tubes. Have 25/40mm dia, fibre-optic coupled input and output windows. Give a good image in low light, need IR illumination in dark places. Our 880nm illuminator is ideal. Use for low light video preamp, etc. Comes with an EHT power supply kit that operates from 9V DC: 25mm version: **$60**, 40mm version **$80**. Tubes with more blemishes, but suitable for very sensitive IR testers: 25mm **$35,** 40mm **$55** (includes EHT supply kit)

HELIUM NEON LASER BARGAIN

Large 2-3mW He-Ne laser head plus a compact potted US made laser power supply. The head plugs into the supply, and two wires are connected to 240V mains. Needs 3-6V/5mA DC to enable. Bargain: **$100**

MOVING MESSAGE DISPLAY PCB

Used, complete PCB assembly with bright dot matrix red LED displays and driver. Circuitry includes twenty 74HC164 ICs. Has 20 displays each with 35 LEDs (700 LEDs!). Displays are in a single line to form a continuous display. Display size is 280 x 18mm, PCB 330 x 75mm. Needs 5V supply. Includes a simple program on disk and instructions to make the display scroll number "1" through all displays, via a computer parallel port. Limited quantity: **$40**

PHOTO TRANSISTORS

Enclosed in clear 5mm housing (like a 5mm LED), 30V/3us/<100nA dark current: **$1.30** or **10 for $9**

12V - 2.5W SOLAR PANEL KIT

US amorphous glass solar panels with backing glass: (S12) **$22** ea **4** for **$70**

SOLAR REGULATOR

Ref: EA Nov/Dec 94 (intelligent battery charger). Efficiently charge 12-24V batteries from solar panels, but can also be used with simple car battery chargers to prevent overcharging. Very high efficiency due to MOSFET switch and Shottky diode. 7.5A or 15A kit: **$26**/**$29** (K09)

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors) and components kit (K03) **$15.** Suitable plugpack (PP2): **$6** Weatherproof box: (HB4) **$2.50**. Box for power supply: (HB1) **$2.50** Rabbit-ears antenna (RF2) **$7** (MAR-6 available separately)

STEPPER MOTOR DRIVER KIT

Includes a large used 1.8º. (200 step/rev) motor and used SAA1042A IC. Can be driven by external or on-board variable frequency clock generator. External switches (not provided) or logic levels from a computer etc determine CW or CCW rotation, half or full step operation, enable/disable, clock speed. PCB and all on-board components. Kit with 1 motor **$18**, kit with 2 motors **$28.**

COMPUTER CONTROLLED STEPPER MOTOR DRIVER KIT

PCB and components kit plus information and IBM software: (K21) **$35**. Kit plus 2 stepper motors (small M17 or large M35) (K21M): **$48**

FAX POLLING

Back by popular demand. Poll (02) 9570 7910 for our list of items. Updated every month.

MINI TV STATION

Make your own mini TV station with this metal cased, commercial transmitter with telescopic antenna. Dimensions 123 x 70 x 20mm, 12V operation. Includes power switch, indicator LED, RCA audio and video connectors, twin RCA-RCA lead. Our 32mm AUDIO PREAMPLIFIER kit with electret microphone (**$8**), and a CCD camera completes the station. Transmitter: **$30.** When purchased with a CCD camera **$20**. Regulated 10.4V-500mA plugpack to suit: **$10**

AUDIO - VIDEO MONITOR

Compact high res 5" screen B/W audio and video monitor. Has two way audio, built in mic, audio amp, speaker and "talk" pushbutton. Add a preamp and mic for remote audio monitoring (our 32mm audio preamp is ideal). Has two camera inputs and manual or auto switching (adj speed) between each camera, and audio and video outputs to connect to a VCR etc. Needs 12V DC 1A (our switched mode supply is ideal). Monitor and 6-way mini input connector only: **$125**

SWITCH MODE POWER SUPPLY

Compact (50 x 360 x 380mm), in a perforated metal case, 240V AC in, 12V DC/2A and 5VDC/5A out: **$17**

12V VCR

IR remote controlled 12V VCR with record and playback (no tuner): **$299**

CCD CAMERA

Tiny (32x32x27mm) CCD camera, 0.1 lux, IR responsive (works in total dark with IR illumination), connects to any standard video input (eg VCR) or via a modulator to aerial input: **$120**,

KITS FOR CCD CAMERA SECURITY

New INTERFACE KIT FOR TIME LAPSE RECORDING: now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: **$25** for PCB and all on-board components, used PIR to suit: **$12.**

- **32mm 10 LED IR ILLUMINATOR** new IR (880nm) LEDs have an output about equal to our old 42 LED IR illuminator: **$18.**
- **32mm AUDIO PREAMPLIFIER** An **$8** kit that produces a 'line level' signal from an electret microphone, connect the output to our:
- **UHF VIDEO TRANSMITTER** (**$30**) or **$20** when bought with the camera. for a complete Audio-Video link.

32mm AUDIO AMPLIFIER: An LM380 based **$9** audio power amplifier which can directly drive a speaker — needs the 32mm preamplifier. *WHAT IS 32mm?* All boards are 32mm dia, so you can house these kits in a plastic 32mm joiner: cheap plumbing part.

PC POCKET SAMPLER KIT

Ref EA Aug '96. Data logger/sampler, connects to PC parallel port, samples over a 0-2V or 0-20V range at intervals of one/hour to one/100uS. Monitor battery charging, make a 5kHz scope etc! Kit includes on-board components, PCB, plastic box and software (3.5" disk): (K90) **$30**

WOOFER STOPPER Mk II

Works on dogs and most animals, ref SC Feb 96. PCB and all on-board components, transformer, electret mic & horn piezo tweeter: (K77) **$43**, extra tweeters (drives 4): **$7** ea Approved 12V plugpack (PP6) **$14** **UHF REMOTE TRIGGER** Single channel Rx and Tx: (K77T) **$40**

USED ICs

Guaranteed, previously socketed ICs, never soldered to. Data not supplied.

- 146818P — real time clock: **$4**,
- R65C21P2 — 6821 PIA: **$2**
- P8031 — 8-bit CPU: **$2**
- 6803 — 8-bit CPU: **$4**
- HD680G — 8-bit CPU: **$4**
- R6545 — CRT controller: **$2**
- HD6845 — CRT controller: **$2**
- HD6821 — interface adaptor: **$1**
- AY3-1015 — 8-bit UART: **$4**
- 27C64 — EPROM: **$2**
- 27C256 — EPROM: **$3**

LIMITED STOCK SPECIALS

- BRIDGE RECTIFIERS: 35A - 400V in diecast aluminium: **5** for **$15**
- TRIACS: Mitsubishi BCR8PM-8L 8A/400V in insulated case similar to TO220: **10** for **$14**
- SCHOTTKY DIODES: 7.5A/45V Motorola MBR745 TO220: **10** for **$18**
- DC FAN: small DC motor with 3 blade push on plastic fan: **$3**
- PLASTIC HANDLES: Robust recessed, for stage speakers and equipment, 10 mounting holes, dimensions 130 x 170 x 50mm: **$5**
- PLASTIC CORNERS: Robust, dimensions 80 x 80 x 80mm: **$1.30**

USED PIR MOVEMENT DETECTOR

Commercial quality 10-15m range, used but tested and guaranteed, have open collector transistor (BD139) output and a tamper switch, 12V operation, circuit provided: **$10**

5mW/650nm LASER POINTER KIT

YES, NEW 650nm kit. Very bright! Complete laser pointer that works from 3–4V DC. Includes 650nm/5mW laser diode, new handheld case 125x39x25mm, adjustable collimator lens, PCB battery holder: (K35) **$35**

DISCO LASER LIGHT SHOW PACK

The above 5mW/650nm kit plus our AUTOMATIC LASER LIGHT SHOW: **$99**

650nm LASER POINTER SPECIAL

Light weight 2 x AAA pen-size pointer with 650nm laser, very bright: **$55**

650nm LASER MODULE

Our new module has a 650nm laser diode. Very bright! **$50**

WIRELESS IR EXTENDER

Converts the output of any IR remote control to UHF. Self-contained transmitter attaches to IR remote. Kit includes two PCBs, all components, 2 plastic boxes, Velcro strap: (K89) **$39.** (9V battery not included). Plugpack for Rx (PP10): **$11**

MOTOR AND PUMP

New, compact plastic pump with a 240V AC 50Hz 0.8A 91W 2650 RPM induction motor. Very quiet, made in Japan, 160 x 90 x 90mm, 1.2kg, inlet 25mm dia, outlet 20mm dia. Other end of motor has 20mm long 4mm dia shaft. Motor easily removed for rewinding for a lower AC voltage. We calculated 5.5 turns per volt: **$19**

SUPER BRIGHT BLUE LEDS

BY FAR THE BRIGHTEST BLUE EVER OFFERED, super bright at 400mCd: **$1.50** ea or **10 for $10**

5mm LEDS AT SUPER PRICES

- 1Cd red: **10 for $4**
- 300mCd green: **$1.10** ea. or **10 for $7** (*make white light by mixing the output of red green and blue*)
- 3Cd red: **$1.10** ea. or **10 for $7**
- 3Cd yellow (small torch!) also available in 3mm: **10 for $9**
- Super bright flashing LEDs: **$1.50** ea. or **10 for $10**

BATTERY BONUS Twin AAA battery holder and batteries for **60c** with any LED purchase: flash a high int LED for a month! Limit 3 per customer.

CAR ALARM KIT WITH THE LOT

This kit can be armed/disarmed by a hidden switch, or by a UHF REMOTE CONTROL which also has provision for operating a CENTRAL LOCKING KIT. The CAR ALARM kit includes a PCB, all on-board components and ultrasonic transducers. It features ultrasonic movement detection, provision for bonnet-boot protection (pin switches not supplied), vibration detector and a flashing high intensity LED. Four LEDs make for easy diagnostics and setting up: **$35**

CENTRAL LOCKING four door commercial kit that includes 2 master and 2 slave actuators, wiring loom, control unit, necessary hardware and instructions: **$60**

The **UHF REMOTE CONTROL KIT** has a switched relay output for operating an alarm etc, an indicator output for driving a buzzer etc, and logic level outputs for operating the CENTRAL LOCKING KIT. Comes with a ready made transmitter with two pushbuttons (lock, relay on - unlock, relay off), and a receiver PCB and all on-board components. 5 LEDs make for easy tuning and diagnostics: **$35** **SIREN KIT,** includes speaker **$12**

NICAD CHARGER & DISCHARGER

Professional, assembled and tested fast NICAD battery charger and discharger PCB assembly. Switch mode, SMD on double-sided PCB with gold-plated through holes and pads. Has 6 ICs, 3 indicator LEDs, 3 power MOSFETs, a toroidal inductor and over 100 other components. Unregulated input 13.7V DC, 900mA charge current. Appears to use voltage slope detection for charge terminating, also has charge terminating timer (4060). We include a thermistor for temperature sensing. Probably for fast-charging 7.2V AA nicads. Three trimpots givesome adjustment. Basic information provided, plugpack not included. *Bargain:* **$9** ea or **3 for $21**

OATLEY ELECTRONICS

PO Box 89, Oatley NSW 2223
Phone (02) 9584 3563
Fax (02) 9584 3561
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